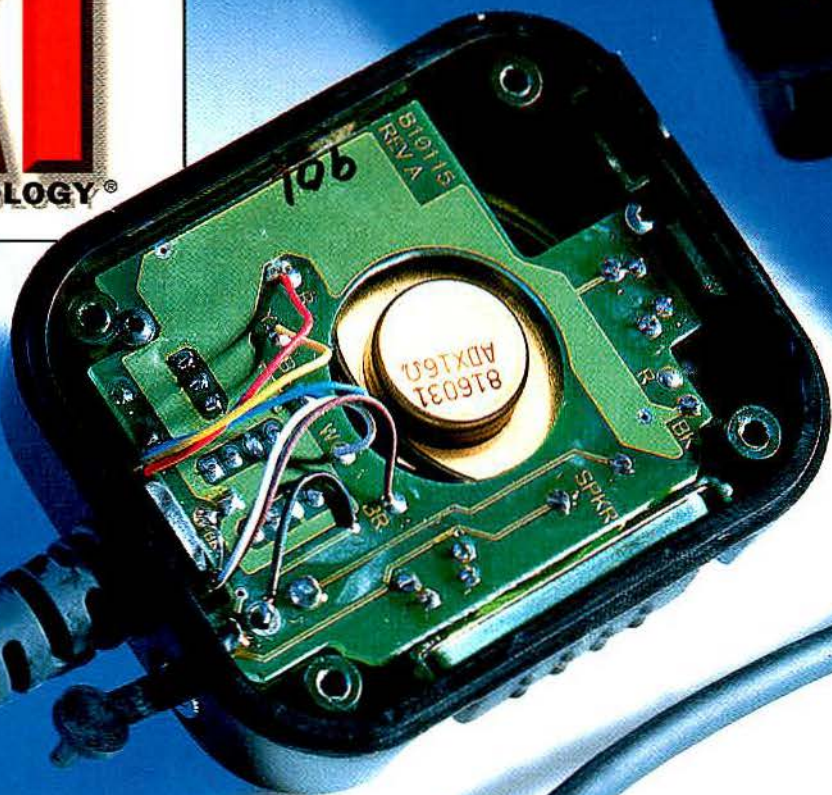


# MRT™

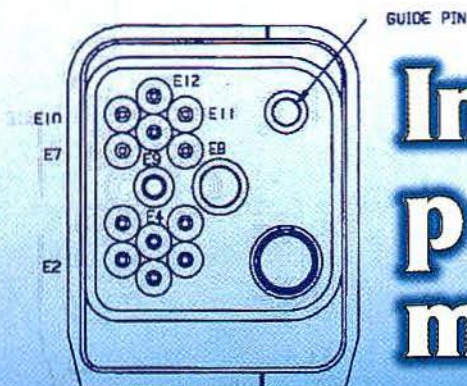
MOBILE RADIO TECHNOLOGY®

JULY 1999

Technical information for private wireless, trunked and networks.



UDC CONNECTOR PIN ASSIGNMENT



## Improving portable radio mic technology



# Vertex--For Business, Industry, and Public Safety.

Vertex Radio Communications, the land mobile division of Yaesu, has been at the forefront of high-tech engineering and quality manufacturing for over 40 years. Always keeping customer satisfaction as their goal, the Vertex line meets the ever-growing demands of private sector, public safety, and governmental organizations.

The Vertex full line of wireless radio equipment is compatible with commercial specifications worldwide, and includes a wide variety of portable, compact/mobile base stations, HF/SSB transceivers,

repeaters, and trunking systems.

Incorporating constant customer feedback with break-through design in synthesized radio communication technology has resulted in innovative products like the FTH-2070 32 Channel 5W Dual Band VHF/UHF Portable radio introduced in 1988. This unequaled radio gained immediate acceptance for its ability to link public safety organizations in time of crisis, and remains unique to Vertex today.

Now, with its expanded line--including the ultra-compact VX-10, 40 and 102 Channel

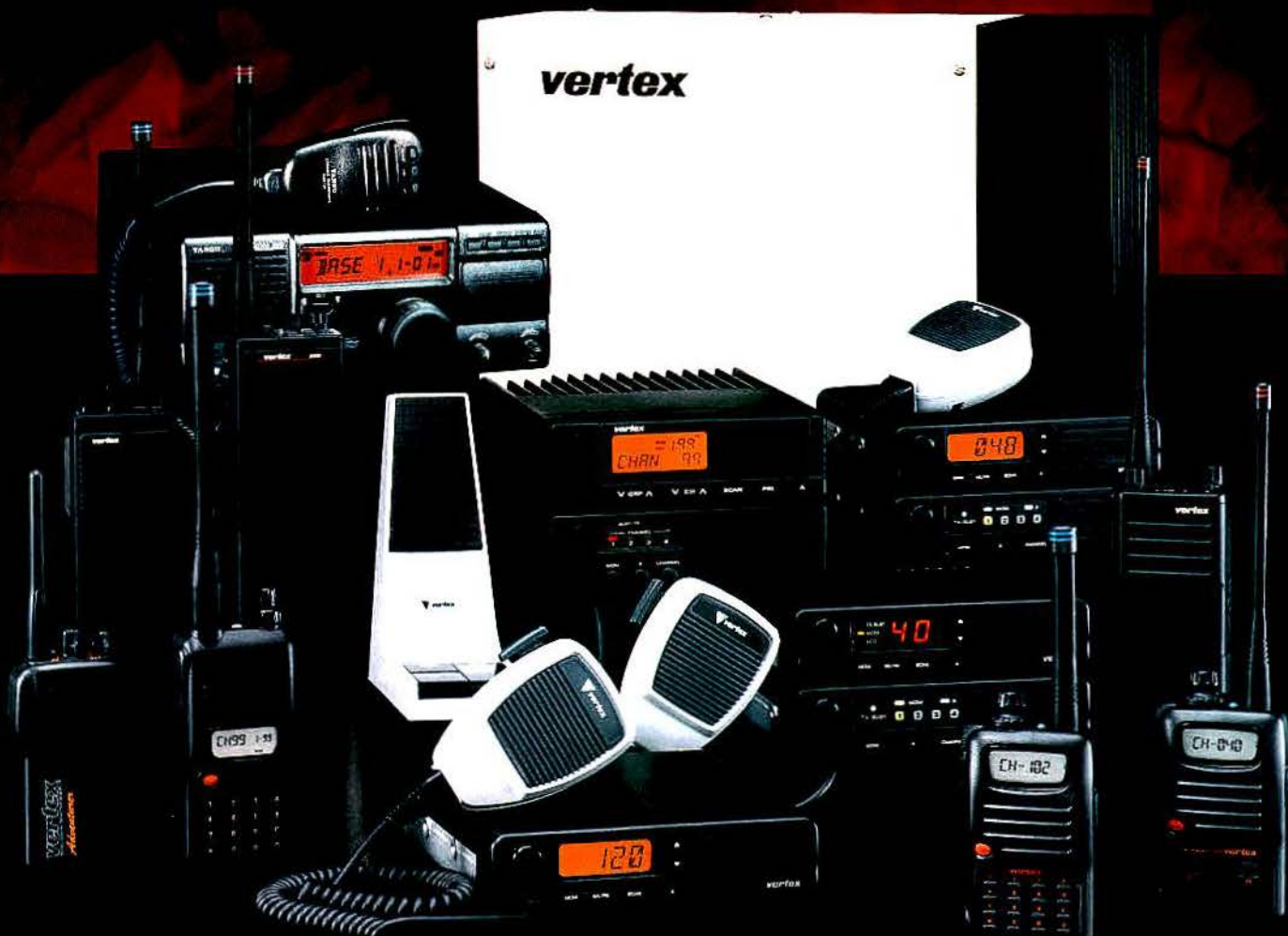
VHF/UHF Portables -- Vertex Radio Communications provides solutions to communication needs for business, industry, and public safety.

For more information about the complete line of Vertex Radio Communications products, see your authorized Vertex dealer, or call:

**562-404-2700**



**vertex**  
RADIO COMMUNICATIONS  
Land Mobile Division of Yaesu U.S.A.



United States & Canada: Yaesu U.S.A., (562)404-2700. Mexico, Central & So. America, (305)593-2500

©1998 Yaesu USA. Specifications subject to change without notice.

Circle (1) on Fast Fact Card

Get **More** From  
Your System.  
Enhance to LTR-Net™...

**Multi-Site Networking**

- Wide-Area Coverage
- Roaming with Auto-Registration

**65,000 Unique ID's**

**Electronic Serial Numbers**

**Direct Radio-to-Radio calls**

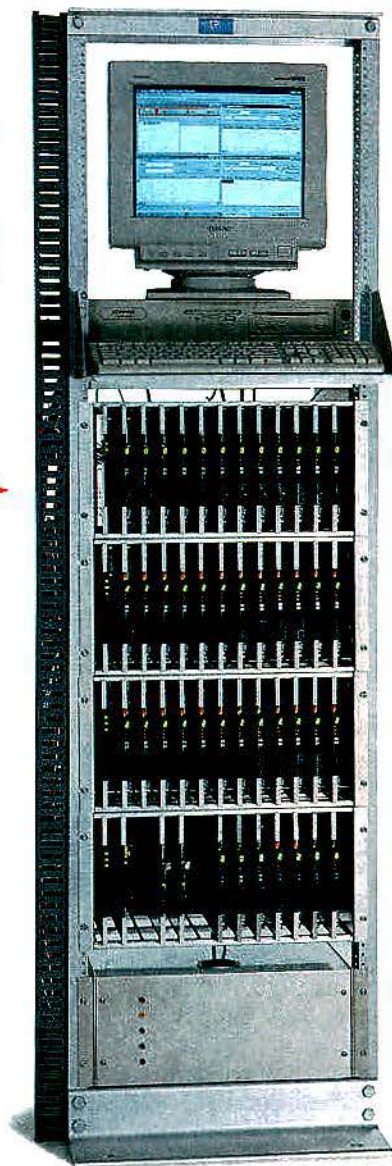
**Direct Inward-Dialed Phone Calls**

**4,780 Group ID's**

**Over-the-Air Management**

- Sleep
- Kill
- Update Channels
- Interrogate ESN or UID

**Get The Switch.**



3000 Series Switch  
Four-Shelf Rack with up to 24-Channel Capacity  
Configurations may vary.

**Call for Details**

1-800-388-1912



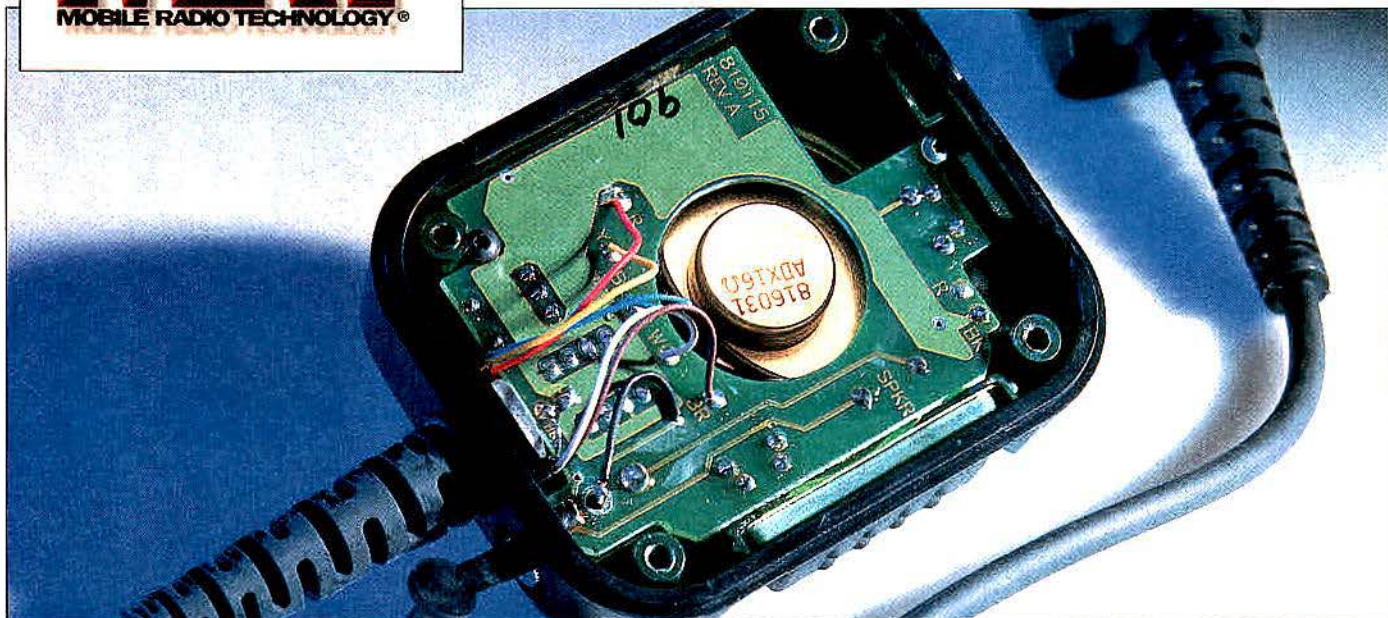
EFJohnson is a registered trademark and LTR-Net is a trademark of Transcrypt International, Inc.  
©1999 Transcrypt International, Inc.

\*Offer subject to restrictions. Contact sales representative for complete details.

Circle (4) on Fast Fact Card



# contents



**On the cover:** Efforts to improve hand mic technology are driven by environmental needs and application-specific acoustics. See cover story on page 18. Cover design by Scott Dolash, art director. Photography by Al Pitzner. Remote speaker-mic diagram courtesy of Otto Engineering, Carpentersville, IL. Otto mic courtesy of AF CommSupply, Overland Park, KS.

## features

### 18 Improving microphone technology

*Michael J. Major*

As the use of portable radios with hand- or epaulet-mics increases, users are demanding more environmental versatility and a wider range of features.

### 24 Controlling base stations over microwave

*Jeff Ashley*

New wireless applications have caused increased demand for base station and circuit transport equipment. Circuit voice frequency and signaling schemes are necessary in implementing any remote radio system controlled over microwave.

### 40 Product/logo directory

Consult this list of leading telecommunications service and equipment providers.

### 42 Watch out for Y2K

*Nikki Chandler*

We're not going to tell you again: Jan. 1, 2000, is looming around the corner. Agencies and companies not actively fixing their systems should be making contingency plans. The FCC finds medium-sized public safety entities and service providers to be most at risk.



## departments

### 4 Editorial

*Don Bishop*

See no evil, hear no evil, email no evil.

### 8 Calendar

*Editorial index*

### 10 Editorial forum

*David Keckler*

Elementary—not secondary.

### 12 Letters

### 14 In the public interest

*Robert H. Schwaninger Jr.*

800MHz relocation: It's about leverage.

### 47 News

ComSpace readies DCMA for 2000.

### 49 Product focus: Batteries.

### 50 Products

Readers' choice: Pyramid Communications.

### 52 Media

### 53 People

### 54 Classified

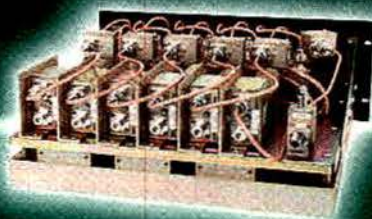
### 68 Ad index



# BUILDING BLOCKS FOR 19" RACK SYSTEMS



For over 20 years, TXRX Systems has built a reputation for quality, innovation, and reliability in mobile radio, personal communication, transportation, public safety, and other services in the 100MHz to 1GHz range. From below-ground to tower-top, TXRX components and systems offer cost-effective, superior performance.



## 800 & 900 MHz Airline Combiners

- Broadband Design
- 175 watts
- Modular Expansion



## Progressive Hybrid Combiners

- Lower Insertion Loss
- Modular Expansion
- Compact Design



## Receiver Multicouplers

- Low Profile
- Expandable to 16 Ports
- Low Noise Figure
- High 3rd OIP

## VHF/UHF Cavity Multicouplers

- Broadband T-Pass® Design
- Easily Expanded

Call 1-800-866-TXRX to discuss your application.

8625 Industrial Parkway  
Angola, NY 14006

Tel: 716-549-4700

Fax: 716-549-4772

E-mail: [sales@txrx.com](mailto:sales@txrx.com)

Internet: <http://www.txrx.com>

A Member of Bird Technologies Group



DUPLEXERS • CAVITY FILTERS • MULTICOUPLER SYSTEMS • SIGNAL BOOSTER SYSTEMS • RF SYSTEM PRODUCTS

Circle (5) on Fast Fact Card



## See no evil, hear no evil, email no evil

Wow. Does it pay to be careful with email? You betcha.

Despite policies about not sending exchanging personal email on government- and company-owned computers, people do. We see it in our company. You see it in yours.

Aside from personal email being a mostly minor misuse of resources (both the time and the equipment) if the email gets passed along to the wrong person, it can be embarrassing. And if it gets passed along to a *lot* of the wrong people, it can be *really* embarrassing.

Case in point:

An FCC employee received personal email from outside the agency. The content was a joke. Um, okay, a filthy joke. With possible religious prejudice. (An FCC official later described the joke as "highly offensive.")

Whether the FCC employee forwarded the joke to others herself, or if someone else did it, is unclear from the email record, but somehow it was forwarded to everyone on the email subscription list for the FCC's *Daily Digest*. The *Digest* lists official actions taken by the FCC every day. About 6,000 people subscribe.

After becoming aware of the error, the employee to whom the joke originally was addressed sent an apology to *Digest* subscribers. And after the mistake drew official attention, the director of the office of public affairs sent an apology, too. She said that disciplinary action had been taken, but she didn't say what action or against whom.

So. What have we learned? First, when *Digest* email is brief, it is suspect. (Hardly anything official that the FCC sends is brief. It's a busy agency.) Second, when it is offensive, it might be about auctioning private radio spectrum. Third, when it is brief, offensive and *funny*, then it might be ... "inappropriate email" (the director's words). The FCC does not use humor in the *Digest*.

Anyway, let that be a lesson to all. Be careful when you forward email. And don't expect anything that unusual (or entertaining or disgusting, depending on your inclination) from the *Digest* again, for a while.

*Postscript*—another time, another technology: Linda Ellerbee, a former NBC-TV correspondent and "news

brief" anchor and a current (I believe) host on a PBS children's series, once worked for a news wire service in Texas. One day, she used a teletype terminal to write a letter to a friend, intending to print the text and mail it. (Remember postal mail?) She pressed the wrong key and sent the letter, which included a stinging criticism of her boss, to wire service subscribers statewide. Her boss fired her, but the news director at one of



the TV stations that received the errant correspondence liked her writing and hired Ellerbee, beginning her career in television.

As for those responsible for the joke? Careers in comedy? Or pornography?

\* \* \*

People are being careful about what they say—publicly—regarding radio interference received by 800MHz analog trunked systems operated in the vicinity of Nextel's 800MHz digital trunked systems.

For example, "IM/EMI Issues: A Conflict of Public Interest" by Joe Kuran in the March issue describes how an analog 800MHz system operated by the Washington County Consolidated Communications Agency (WCCCA) receives interference from an "integrated digital enhanced network" (IDEN) 800MHz system operated by Nextel. Both systems apparently operate within terms of their FCC licenses. Both systems use equipment made by Motorola that apparently functions within specifications.

Privately, people are drawing their

own conclusions about where blame ought to be properly placed, whether on:

- ☐ the FCC for the band plan.
- ☐ Nextel for its base station positioning.
- ☐ Nextel for alleged transmitter noise.
- ☐ Motorola for its transmitters.
- ☐ Motorola for its receivers.
- ☐ WCCCA for using receivers with inadequate adjacent channel rejection.

The first stop in an analysis is to find whether emissions from IDEN transmitters are confined within the FCC-defined emission mask. Most people say it is, but is it? One expert said that the 10-year-old IDEN technology uses the best power control and linearization circuits that were available when they were designed, but that they cannot activate instantly as the transmitter keys. The result is a spreading of the signal so briefly that, although it may exceed the mask, a spectrum analyzer cannot detect it. Although this spreading may be a factor, the bigger part of the problem might be found in the receiver.

Although the FCC regulates transmitter emissions, it doesn't regulate receiver selectivity. Part of the cost of 800MHz equipment pays for receiver design, components and manufacturing. Price competition leads to cost reduction. Through the years, this has meant a reduction of receiver selectivity by some manufacturers so they can post more competitive prices.

So what are the choices?

1. Ask Motorola to apply updated circuitry to control transmitter power and linearization to reduce noise as the transmitter is keyed—and be prepared to pay the price.

2. Ask Motorola to make more selective receivers—and be prepared to pay the price.

3. Apply frequency coordination to adjacent channels, in effect requiring Nextel or public safety agencies or both to abandon otherwise available frequencies.

Do you have some to add to the list?  
—don\_bishop@intertec.com

*Don Bishop*



# **SITE SAVER™**

## Mounting Solutions Get Great Reception From Everyone



### **Introducing DAPA Site Saver Mounting Solutions**

Zoning boards, concerned citizens, wireless users and providers all agree that Site Saver mounting solutions from DAPA are a welcome alternative. Compact and unobtrusive, the Site Saver solution mounts three DAPA antennas on a single pipe. They save space, provide outstanding coverage and can handle high call capacity without compromising the area's aesthetics.

### **Easy On Your Eyes And Your Budget**

Not only are Site Saver solutions the most attractive choice, their low-cost, flexible design makes them ideal for virtually every application and environment. Site Saver mountings work with most DAPA panel antennas, including vertically polarized, or dual (slant 45) antennas. They can be customized for your site with mechanical downtilt, stacking, gap fillers, cylindrical or square radomes.

### **Depend On DAPA To Keep People Communicating**

DAPA celebrates 30 years as a worldwide leader in the design, manufacture and installation of antenna and tower systems. For more information on the Site Saver mounting solutions or other DAPA products, contact us today, and get a great reception without attracting attention.

# **DAPA**

DAPA Communications, Inc.

Allegany, NY USA

1-800-325-3272

Int'l +1-716-373-7228

Circle (6) on Fast Fact Card

[www.dapacom.com](http://www.dapacom.com)





**FEATURES AND NEWS:** Computer-aided dispatch; fire radio and data; APCO preview and guide.

**PLUS:** Robert H. Schwaninger Jr.'s "In the Public Interest"; Don Bishop's editorial; product focus: logging and recording systems.

**AND IN THE MONTHS TO COME:** Railroad communications; the changing face of paging; system upgrades; location technologies; test equipment; hand-held radios focus.



Communications RFPs:

Getting your

money's worth



## REGULATORY CONSULTANT

Robert H. Schwaninger Jr., *Schwaninger & Associates, Washington, DC*

## EDITORIAL ADVISORY BOARD

John Abbey, *The Abbey Group*  
 Gene A. Buzz, *Omnicom Telecommunications Engineering*  
 Jack Daniel, *The Jack Daniel Company*  
 Gary David Gray, P.E., *Orange County Communications*  
 Frederick G. Griffin, P.E., *Frederick G. Griffin P.C.*  
 Jim Hendershot, *Radio Design Group*  
 Samuel J. Klein, *Cellular Design*  
 S.R. McConoughey, P.E., *Mobile Communications Consulting*  
 Art McDole, *Salinas, CA*  
 Tony Sabino, *Regional Communications*  
 Herb Sachs, *Herb Sachs Consulting*  
 Robert C. Shapiro, P.E., *Strategic Telecommunications*  
 Leon Spencer, *Exxon Computing Services Company*  
 Gregory M. Stone, Ph.D., *Quantum Radionics*  
 Raymond C. Trott, P.E., *Trott Communications Group*  
 William A. Wickline, P.E., *Mentor, OH*

## EDITORIAL

Don Bishop, *Editorial Director*  
 David Keckler, *Features Editor*  
 Nikki Chandler, *Senior Associate Editor*  
 Emily Reid, *Editorial Assistant*  
 Harold Kinley, C.E.T., *Contributing Editor*

## DESIGN

Scott Dolash, *Art Director*

## BUSINESS

Larry Lannon, *Vice President, Communications Division*  
 Mercy Contreras, *Group Publisher*  
 Patricia Zahner, *Director of Marketing*  
 Karen Clark, *Marketing Services Supervisor*  
 Melissa Langstaff, *Advertising Production Coordinator*  
 Nancy Hupp, *Director, Corporate Advertising Services*  
 Kristi B. Woods, *Classified Advertising Coordinator*  
 Tom Cook, *Director of Editorial Development*  
 Doug Coonrod, *Corporate Creative Director*  
 Stephanie Hanaway, *Division Director of Marketing*  
 Sheri Gronli, *Corporate Circulation Director*  
 Julie Neely, *Senior Circulation Manager*  
 Customer Service, 800-441-0294 or 913-341-0294  
 Raymond E. Maloney, *Chairman*  
 Cameron Bishop, *President & CEO*  
 Ron Wall, *Chief Operating Officer*  
 PRIMEDIA Information Group  
 Curtis Thompson, *President*  
 PRIMEDIA Inc.  
 William F. Reilly, *Chairman and CEO*  
 Charles McCurdy, *President*  
 Beverly C. Chell, *Vice Chairman*

**CORRESPONDENCE:** Editorial correspondence should be addressed to P.O. Box 12960, Overland Park, KS 66282-2960. tel. 913-341-1300; fax: 913-967-7250; mrt@intertec.com; www.mrtmag.com.

**MOBILE RADIO TECHNOLOGY** provides technical information to dealers; to private wireless, public safety, public service, community repeater, SMR, ESMR, paging, cellular and PCS system operators; mobile radio equipment manufacturers; manufacturers' representatives; distributors; engineering and consulting firms; national, state and local government and public safety agencies; transportation companies; petroleum and energy products companies; public utilities; and others allied to the field.

**PHOTOCOPY RIGHTS:** Authorization to photocopy items for internal or personal use, or the internal or personal use of specific clients, is granted by PRIMEDIA Intertec, provided that the base fee of US \$2.25 per copy, plus US \$00.00 per page is paid directly to Copyright Clearance Center, 222 Rosewood Dr., Danvers, MA 01923, USA. The fee code for users of the Transaction Reporting Service is 0745-7626/1999 \$2.25 + \$00.00. For those organizations that have been granted a photocopying license by CCC, a separate system of payment has been arranged. Prior to photocopying items for educational use, please contact CCC at 978-750-8400. Organizations or individuals with large quantity photocopy or reprint requirements should contact Jenny Eisele, 913-967-1966.

**BACK ISSUES:** Copies of most issues printed within the past two years are available for \$10 per issue; older issues are not. Call customer service at 800-441-0294.

## ADVERTISING SALES OFFICES

### OVERLAND PARK, KANSAS

Joyce Bollegar, 913-967-1840,  
*East Region (including Eastern Canada)*  
 Fax: 913-967-1901  
 Email: joyce\_bollegar@intertec.com  
 Dawn Rhoden, *Classifieds*,  
 913-967-1861, Fax: 913-967-1735  
 Lori Christie, *List Rental Services Representative*,  
 913-967-1875, Fax: 913-967-1897  
 9800 Metcalf Avenue  
 Overland Park, KS 66212-2215

### SANTA ROSA, CALIFORNIA

Dennis Hegg, *West region (including Alaska, Hawaii and Western Canada)*  
 Phone: 707-541-3763, Fax: 707-541-3721  
 Email: dennis\_hegg@intertec.com  
 3428 Mendocino Ave.  
 Santa Rosa, CA 95403

### ENGLEWOOD, COLORADO

Mercy Contreras, *Group Publisher*  
 Phone: 720-489-3199  
 Fax: 720-489-3253  
 5680 Greenwood Plaza Blvd., Suite 100  
 Englewood, CO 80111

### OXFORD, ENGLAND

Stephen Bell, *International*  
 Phone: +44 181 286 8889  
 Fax: +44 181 286 8898  
 P.O. Box 98  
 Worcestor Park, Surrey, KT4 8WB  
 United Kingdom



This publication is available in paper or electronic format from Information Express, 3221 Porter Drive, Palo Alto, California 94304-1225. Contact Information Express at 650-494-8787, or visit IE online at [www.express.com](http://www.express.com). This publication is also available via microform and/or electronic databases from Bell & Howell Information and Learning, 300 N. Zeeb Road, P.O. Box 1346, Ann Arbor, MI 48106-1346. Contact UMI at 800-521-0600 (734-761-4700 outside North America) or check UMI's Web site ([www.umi.com](http://www.umi.com)) for additional information on format availability.

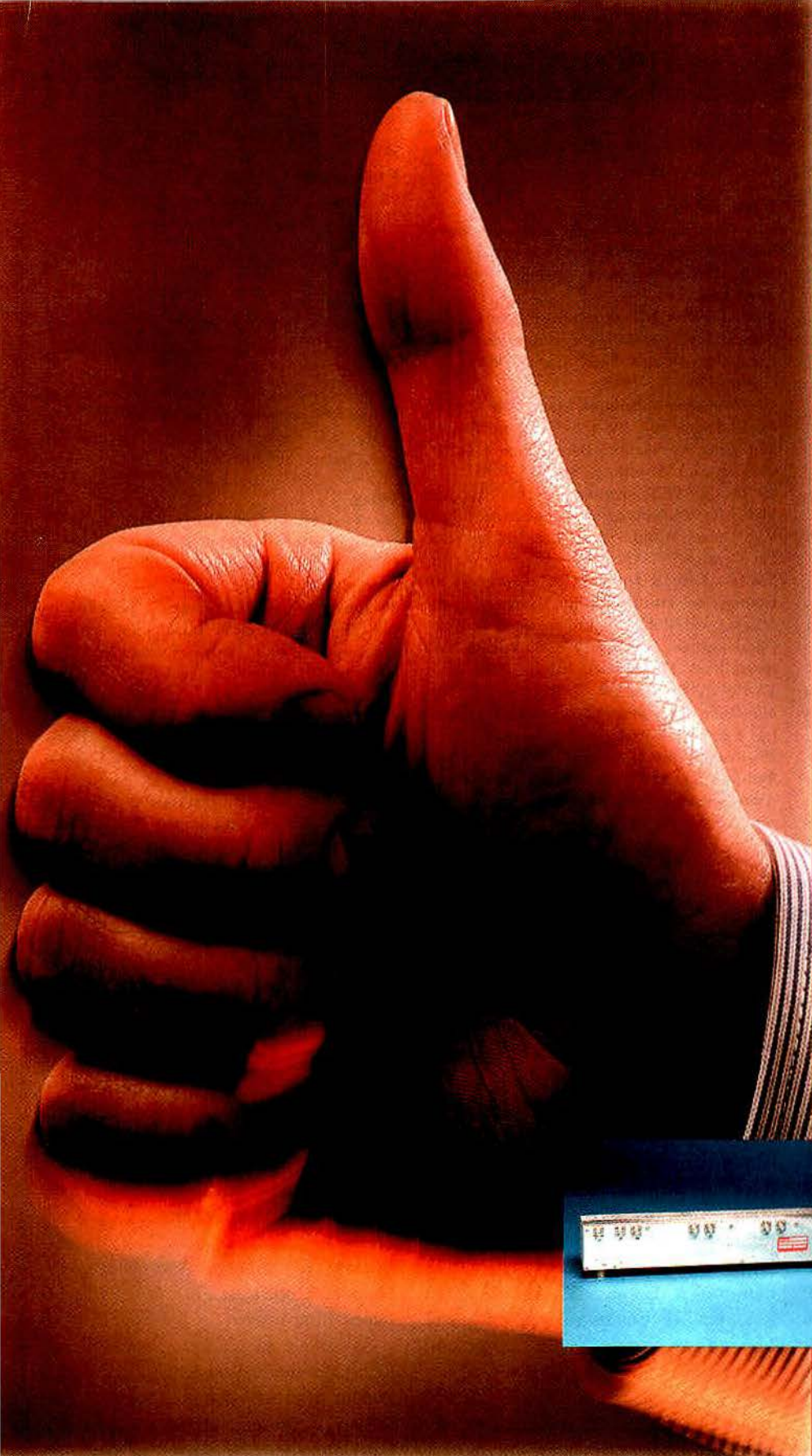
**INTERTEC PUBLISHING**  
 A PRIMEDIA COMPANY



Audited circulation.

© 1999 by Intertec Publishing Corporation, A PRIMEDIA Company. All rights reserved.





# Is it possible to boost base station RF output over 12% without redesigning your amplifiers?

Yes—with the Narda low-loss Switchable Divider/Combiner. It's the only device that significantly increases convenience and optimizes signal power for your base station by combining a signal divider, a switch and a combiner all in one unit.

But what makes this device especially unique is its output switching ability for as many as four amplifiers. During operation, the logic-controlled patented switch combiner maximizes flexibility, and minimizes RF path loss, by automatically configuring the device to accommodate the number of on-line amplifiers in the most ideal way. The amplifier outputs are combined into one high-power, low-loss output of up to 250 watts CW.

Narda's Switchable Divider/Combiner achieves all this with a combined insertion loss <0.5 dB and a VSWR <1.4:1 regardless of the number of combined inputs.

Without our multi-function device, you're faced with both inconvenience and the loss of power. Not to mention the fact that you miss out on the thumbs-up reliability built into

every quality Narda product.

To find out more, call us at **516-231-1700**. Or call our Faxback and ask for document 1119 at **1-800-4NARDANY**.



**narda**  
microwave-east

an **L3** communications company

*It's Narda to be precise.*

Circle (7) on Fast Fact Card



© 1998 L-3 Communications, Inc.



# calendar

## July

**14-16—Communications Expo/Show of the Americas**, Miami Beach Convention Center, Miami. Contact: Jackie Gonzales, 305-412-9000.  
**26-28—Telecommunications Resellers Association Summer Carrier Forum**, Westin Harbor Castle, Toronto, Ontario Canada. Contact: 202-835-9898.

## August

**8-12—Association of Public-Safety Communications Officials—International (APCO) National Conference**, Minneapolis. Contact: 904-322-2500.

## September

**19-22—Fall Vehicular Technology Conference**, sponsored by IEEE Vehicular Technology Society, Amsterdam, The Netherlands. Contact: 904-322-2500.  
**23-25—Personal Communication Showcase**, sponsored by Personal Communications Industry Association, New Orleans. Contact: 703-739-0300.

## October

**2-4—Wireless I.T. '99**, sponsored by the Cellular Telecommunications Industry Association, Santa Clara, CA. Contact: 202-785-2842.  
**18-21—Annual APCO Canada Conference**, sponsored by APCO, New Brunswick Canada. Contact: Jim Flanagan 888-CANAPCO.  
**27-30—Industrial Telecommunication Association/USMSS joint Conference**, sponsored by ITA

and USMSS. Grand Hyatt, Washington, DC. Contact: 703-528-5115.

## November

**1-4—Telecommunications Resellers Association Fall Conference and Exposition**, sponsored by TRA, Dallas. Contact: 202-835-9898 or www.tra.org.  
**2-4—Wireless I.T.**, sponsored by the Cellular Telecommunications Industry Association, Santa Clara Convention Center, Silicon Valley, CA. Contact: 202-785-2842.  
**10-14—Communications Marketing Conference**, sponsored by the Communications Marketing Association, Harvey Hotel, Dallas. Contact: Jack Armstrong, 410-628-9300.  
**15-16—AMTEX**, sponsored by the American Mobile Telecommunications Association, Hilton, Walt Disney World Village, Lake Buena Vista, FL. Contact: 202-331-7773.  
**15-16—Fourth International Congress on Commercial Trunked Radio**, sponsored by the International Mobile Telecommunications Association, Hilton, Walt Disney World Village, Lake Buena Vista, FL. Contact: 202-331-7773.  
**17-19—TelecomLatina**, co-sponsored by *Mobile Radio Technology*, Miami Beach Convention Center, Miami. Contact: 800-288-8606.  
**19—Radio Club of America Communications Symposium, 91st Anniversary Dinner and Awards Presentation**, New York Athletic Club, New York. Contact: Gerri Hopkins, 732-842-5070.

## 2000

### February

**28-March 1—Wireless 2000**, sponsored by the Cellular Telecommunications Industry Association, Ernest Morial Convention Center, New Orleans. Contact: 202-785-0081.

### March

**19-22—ENTELEC 2000**, sponsored by ENTELEC, Dallas Convention Center, Dallas. Contact: 281-357-8700.  
**22-24—International Wireless Communications Expo**, co-sponsored by *Mobile Radio Technology*, Las Vegas Convention Center, Las Vegas. Contact: 800-288-8606.

### May

**8-11—Telecommunications Resellers Association Spring Conference and Exposition**, Philadelphia Marriott. Contact: 202-835-9898 or www.tra.org.  
**30-June 1—Canadian Wireless**, sponsored by the Canadian Wireless Telecommunications Association, Toronto, Canada. Contact: 613-233-4888, ext 102, or www.cwta.ca.

### June

**4-8—Supercomm**, sponsored by TIA and USTA, Georgia World Congress Center, Atlanta. Contact: 800-278-7372.  
**25-29—UTC Telecom**, sponsored by UTC, The Telecommunications Organization, Phoenix. Contact: 202-857-1881.

# editorial index

Advanced Charger Technology .....	48	EMR .....	40	Pyramid Communications .....	50
AEA .....	40	Enrev .....	48	Ritron .....	40
Aerotron-Repcos Systems .....	50	Globecomm Systems .....	52	SCA .....	40
Alexander Technologies .....	49	Hawker Energy Products .....	49	Schwaninger & Associates .....	14
Andrew .....	63	Huber + Suhner Integrations .....	63	SEA .....	47, 48
Antenna Specialists .....	50	Huber + Suhner .....	63	Shure Brothers .....	20, 40
Artech House .....	52	Hutton Communications .....	40	SmartLink Developmont .....	48
Battery Engineering .....	49	Intek Global .....	47	Tadiran .....	49
Berkeley Varitronics Systems .....	40	iTech .....	40	Telecom Analysis Systems .....	63
Chase Systems .....	40	Kenwood Communications .....	48, 50	Telepath .....	41
Citel .....	40	Kenwood Systems .....	48	Television Equipment Associates .....	19
Communications Specialists .....	40	Lenbrook .....	48	Thunder Eagle .....	41
ComSpace .....	47, 48	Lindgren RF Enclosures .....	52	Times Microwave	
Connect Systems .....	40	Maxrad .....	50	Systems .....	41, 50, 63
Contact East .....	52	Modular Communications		TPL Communications .....	41
Daniels Electronics .....	40	Systems .....	40	Trident Micro Systems .....	48
DAPA Communications .....	40	Motorola .....	4, 40, 47	Trilogy Communications .....	63
Datamarine International .....	48	Motorola Accessories and Aftermarket		Tru-Connector .....	63
Dataradio .....	40	division .....	52	TX RX .....	41
Davicom Technologies .....	40, 63	Motorola Land Mobile Products		Uniden America .....	47
Doppler Systems .....	40	sector .....	22	Vega .....	41
Earmark .....	20	Nextel Communications .....	4	Vertex Standard .....	41
EFJohnson/		Nextel License Holdings .....	48	W&W Manufacturing .....	41
Transcript International .....	40, 48	Otto Engineering .....	22	Zetron .....	41, 48



# Full Spectrum. Fully Analyzed.

WITH EXTERNAL MIXERS  
Up to 110 GHz



MS2667C  
9kHz to 30GHz



MS2653B/63B/63C  
9kHz to 8GHz



MS2668C  
9kHz to 40GHz

MS2665C  
9kHz to 21GHz



MS2651B/61B/61C  
9kHz to 3GHz

Anritsu portable spectrum analyzers have you covered.

In range. Performance. Portability. And value.

Frequencies up to 40 GHz – 110 GHz with Anritsu external mixers – handle any need you have. So does performance. With dynamic range exceeding 105dB. Noise below -110dBm.

And a synthesized local oscillator that stops drift in its tracks. So whether you analyze AM/FM signals, digital mobile communications, CATV equipment or frequencies into the mm range, Anritsu delivers heavyweight performance in a small 22 pound package.

And you get something more. More for your money.

So when you analyze the need, you'll see there's no real option. There's a new standard in spectrum analyzers. Call 1-800-ANRITSU today.

## Fully Featured.

- ☒ High selectivity or Gaussian filtering
- ☒ Ultra-sharp 5.7" color display
- ☒ Channel Power, Adjacent Channel Power, Occupied Bandwidth, Burst Power, Noise Power measurement functions and Frequency counter
- ☒ PCMCIA memory card interface\*

\* Compatible with up to 2MB memory cards. Free 256kB memory card with each analyzer purchased.

## Anritsu MS2650/60 Series Spectrum Analyzers

# Anritsu

One world. One name. Anritsu.



© 1999 Anritsu Company. Sales Offices: United States and Canada, 1-800-ANRITSU; Europe 44 (0)1582-431200; Japan 81 (0)3-3446-1111; Asia Pacific 65-28224000; South America 55-21-286-9141. <http://www.anritsu.com>

Circle (8) on Fast Fact Card





## Elementary—not secondary

For two months, microphone-toting and keyboard-pounding pundits have linked their own agendas to the tragedies in Littleton, CO, and other U.S. cities. Many have stretched to connect the shootings to content relevant to their listeners or readers. School shootings aren't our editorial focus, either, but they do draw attention to challenges within the radio industry, such as interoperable public safety emergency communications. They also create an appropriate moment to question how school district

communications are prioritized and to remind private radio to be a good RF neighbor to schools.

Major issues face school radio: faulty coordination, hazardous interference and vulnerability to auctions under NPRM 99-87. Sometimes, more powerful stations are licensed too near schools, geographically or on the band, effectively blocking schools' use of their channels. Co-channel users have ordered bus drivers to get off the radio in language that shouldn't spew out of a mobile radio on a kindergarten bus. Vague language in the NPRM threatens schools' status as small governmental entities and could cast them into the bear pit of spectrum auctions when they can't even afford fresh chalk.

Aside from the recent aberrations, consider the typical, radio-dependent challenges schools face: maintaining order and safety at sporting events and off-campus excursions, staff and student security, maintenance and physical plant activities—and transportation.

Schools must not only meet the needs of average students but also the health and safety obligations thrust upon them by entitlements, mainstreaming of challenged students, the ADA, OSHA, state legislatures, the U.S. Department of Education, the NEA and God only knows who else. Protected spectrum for fixed-location activities is non-debatable; on buses, it's a no-brainer.

Some may argue that any public transportation—bus, train, light rail, taxicab—deserves equally protected frequencies to ensure passenger safety. Except that those passengers assume an acceptable risk and *choose* those conveyances. School buses are *assigned* transportation—the kids don't elect to use them. This creates liabilities for busing vendors and school districts, most of which (outside of 90210) are strapped for cash. None would hesitate through a 15-minute recess to subrogate a legal claim for a student injury against any business whose radio procedures might have delayed response to that incident. If the schools don't think of it, you can bet your yagi their lawyers will.

Auto clubs and other entities argue that they, too, deserve public safety/public service exemptions. Maybe so, but let's take care of the schools *first*, and *then* worry about stranded motorists.

—David Keckler

david\_keckler@intertec.com

## Are you in Dispatching Hell?



### Vega's Model C-6124

Get out of the heat with Vega's model C-6124, with its cool touch-screen and independent line selection. The C-6124 offers up to 24-line control, instant PTT, and loads of additional features.

Any line can be configured as a dedicated 2/4 wire radiocircuit, dial-up access or full duplex conventional PSTN telephone circuit, (simply plug in the appropriate module). Any combination of lines can be set-up in a crosspatch mode. C-6124 with its future expandability will keep you out of the inferno.

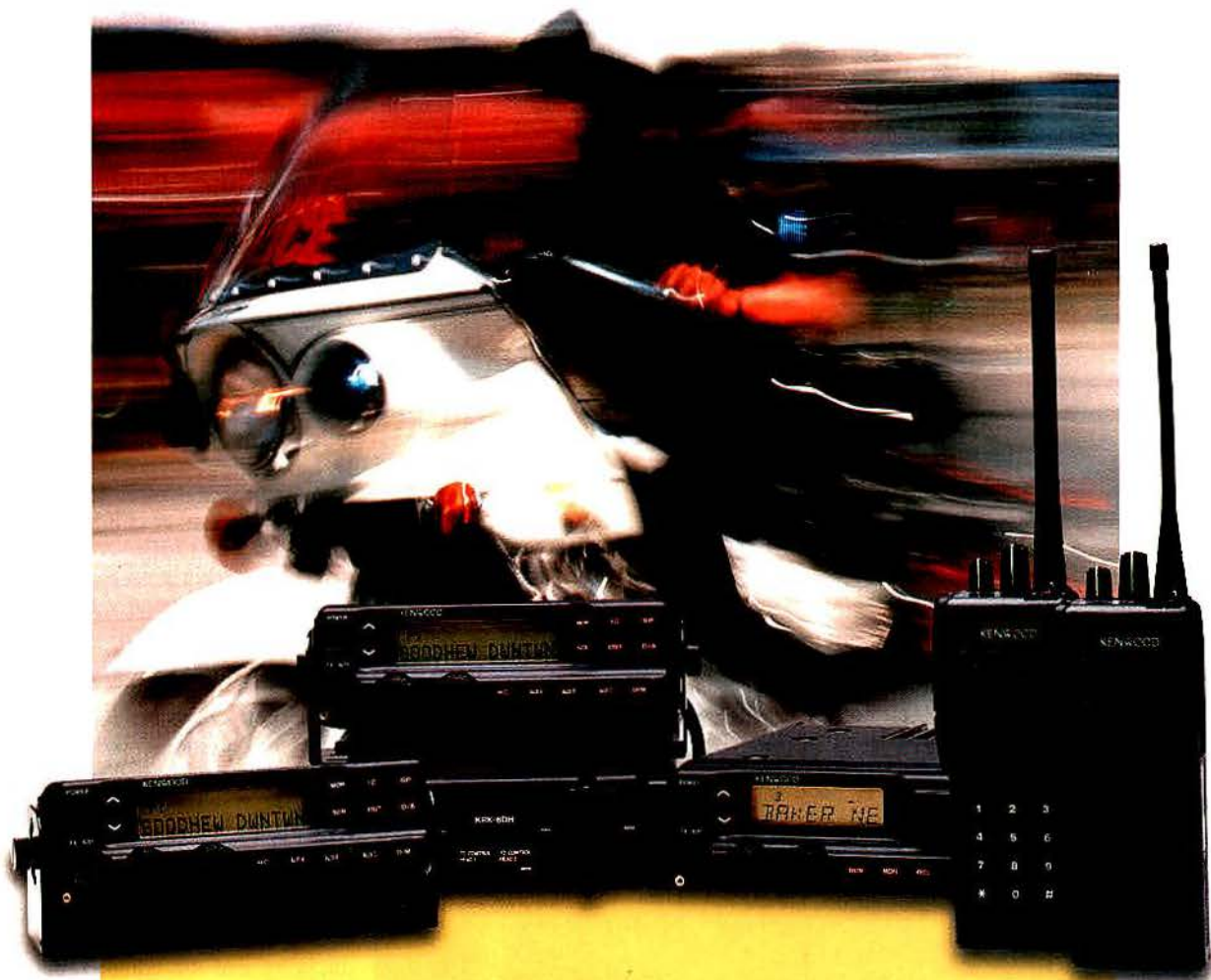


9900 East Baldwin Place  
El Monte, California 91731-2294

Telephone: (626) 442-0782  
Toll-Free: 800-877-1771  
Fax: (626) 444-1342 • FaxBack:  
(626) 444-2017 / 800-274-2017  
email: [vega\\_signal@earthlink.net](mailto:vega_signal@earthlink.net)  
[www.vega-signaling.com](http://www.vega-signaling.com)



# When critical conditions call for backup...



## You need a reliable partner.

Public service agencies throughout the world require quality and performance in two-way radio communications. That's why Kenwood Communications is the name they rely on. See it for yourself in the new 90 series mobiles and portables that set a new standard for quality and versatility.

# KENWOOD

**Always on duty.**



Call for a free Product Guide: **1-800-950-5005** [www.kenwood.net](http://www.kenwood.net)



## 800MHz interference poses problem

In "IM/EMI Issues: A Conflict of Public Interest," (March 1999) author Joe Kuran astutely noted that interference by 800MHz systems prior to ESMR systems was not a problem. But with the FCC's adoption of the First Report and Order (FCC 95-501 Dec. 15, 1995) and Memorandum Opinion and Order on Reconsideration (FCC 97-224 June 23, 1997) in the PR Docket No. 93-144 (ESMR) proceeding, interference to public safety sys-

tems has exponentially increased. Public safety, and in particular, Region-20 public safety, attempted to address this very issue with the FCC back in PR Docket No. 93-60, which dealt with future short-spacing protection criteria for systems operating in the 800MHz band.

On May 28, 1993, Region-20 filed a 594-page set of comments to PR Docket No. 93-60. In these comments, Region-20 submitted elaborate technical data and analysis to show that future commercial

SMR/ESMR short-spacing against existing 800MHz public safety systems using a 40/22dBu d/u protection criteria would cause deleterious harmful interference to public safety.

Post Reply Comment period closure, Region-20 representatives conducted an oral *ex parte* presentation with the then Chief and Deputy Chief of the Private Radio Bureau Ralph Haller and Beverly Baker. At this meeting, extensive discussions were undertaken regarding the proposed insufficient protection criteria for future SMR/ESMR systems short-spaced against existing 800MHz public safety systems and our 594-page comments submitted to the proceeding substantiating this viewpoint.

At the conclusion of our meeting, Haller and Baker both seemingly concurred that the proposed 40/22dBu d/u protection criteria was insufficient to protect existing 800MHz public safety systems from future SMR/ESMR systems. However, they also noted that Region-20's counter proposal of a 40/5dBu d/u was too conservative. A compromise position of around 40/17dBu d/u short-spacing protection criteria to existing 800MHz public safety systems was reached.

But when the Report and Order in PR Docket No. 93-60 (FCC 93-450 Sept. 22, 1993) was adopted, the FCC essentially reneged on the understanding it had given to Region-20 and adopted their proposed 40/22dBu d/u short-spacing for all 800MHz systems on the basis that a 40/22 dBu d/u protection criteria "will provide reasonable protection from co-channel interference and, at the same time, provide for efficient re-use of this valuable spectrum" (R & O, par. 7), clearly implying that the commercial profitability from the use of this spectrum was more important than public safety interests and concerns. As a result, the entire country is now experiencing that exponential increase in interference to 800MHz public safety systems by short-spaced ESMRs as predicted by Region-20.

Though I respect the effort Congress is making to address the issue in H.R. 4813, it falls under the saying, "A little too late." As far as I am concerned, it will take "an act of God" to retroactively enforce increased short-spacing protection criteria upon ESMR systems. Prospectively, public safety entities are being forced onto the 700MHz and 821MHz public safety bands to overcome this problem, a problem that should never have been allowed to occur in the first place.

—Michael C. Trahos  
Alexandria, VA

## Protect your Workers



**RadMan**  
a key part of your  
RF Safety program



The only RF monitor for both  
magnetic and electric fields  
according to FCC regulations

Contact: Chase Systems Inc.  
tel: 973-252-6605  
fax: 973-252-6607  
e-mail: chasesys@gti.net

**Safety Test Solutions**  
from Wandel & Goltermann





# Got a test?



## We've got the Analyzer.

Start with our standard Communications System Analyzer platform, the rugged, dependable, easy-to-use R-2600. As your test needs grow, our upgradeable R-2600 family of System Analyzers is designed to grow with you.

For fully compatible iDEN® equipment testing, we offer the R-2660. For ASTRO®, SmartZone™, SMARTNET™, SECURENET™ and Project 25 systems compliance, you need

the R-2670. And to test MPT 1327/1343, look no farther than the Motorola R-2680.

Whatever the test, we've got the answers. For complete details or a product demonstration, contact us today:

Phone: 800-422-4210

Fax: 800-622-6210

Web: <http://AccessSecure.mot.com/Accesspoint>

Motorola, iDEN and ASTRO are registered trademarks of Motorola, Inc. SmartZone, SMARTNET, SECURENET and "The Test You Can Trust" are trademarks of Motorola, Inc. © 1999, Motorola, Inc.**MOTOROLA**



## 800MHz relocation: It's about leverage

By Robert H. Schwaninger Jr.

To prepare for the possible relocation of your use of the upper 200 SMR channels, the first step is to put the matter in perspective. This is a *contract* negotiation. It is *not* an engineering problem or an RF design problem. It cannot be solved with a few crystals and a screwdriver.

Because it's a contract negotiation, you should first note who has the leverage in the negotiation. The answer is the site-based licensee. That primacy was made a portion of the FCC orders granting relocation authority to EA licensees. They got the authority, and incumbents got the leverage. Put another way, EA licensees have all of the obligations to make relocation work under the FCC requirements. Site-based licensees only have to be reasonable and cooperative. The FCC never said that saying "no" to unreasonable demands and terms from an EA licensee was an unacceptable option.

### Preliminary matters

To get ready to talk to an EA licensee about relocation, I suggest you do a little reading. Start by looking over the FCC's decisions: Memorandum Opinion and Order, FCC 97-244, PR Docket 93-144 (July 10, 1997) and the First Report and Order, Eighth Report and Order and Second Further Notice of Proposed Rule-making, FCC 95-501 (Dec. 15, 1995).

Schwaninger, MRT's regulatory consultant, is the principal in the law firm of Schwaninger & Associates, Washington, which is general counsel to Small Business in Telecommunications. Schwaninger is also a member of the Radio Club of America.

Until you read the FCC's decisions and formulate a strategy, politely accept notification from the EA licensee, but don't be filling out forms, schedules, lists, etc being circulated by

can always reduce your demands, but as with all contract negotiations, know where the edge of the envelope is.

### The first draft

After getting up to speed, you are going to find out that EA licensees must comply with myriad obligations and agree to bear a number of costs to demonstrate the ability to engage in relocation. The length of this column doesn't permit a full recitation of those obligations. However, here are a few that you might look for in the first draft.

The EA licensee should agree to bear all costs of relocation, including hardware, software, design, installation, increased rents, legal, etc. EA licensees will try to flat-rate or cap these amounts. Because most licensees don't have a crystal ball, flat rating the amounts is silly. Therefore, negotiate a formula that will neither abuse the EA licensee nor leave you holding the bag.

The EA licensee must articulate a method for providing a "seamless" transition that avoids disruption of service. The FCC orders contemplate the construction of additional repeater facilities, that would be tested and tried prior to turning off the channels to be relocated. The EA licensee should be prepared to reduce to terms and warranties

the way that the seamless transition will be accomplished and how the EA licensee will be able to perform.

### The channels

As a preliminary matter prior to execution of an agreement with the EA licensee, you should ask which channels are being offered in exchange for your upper 200 channels. Then, using that in-

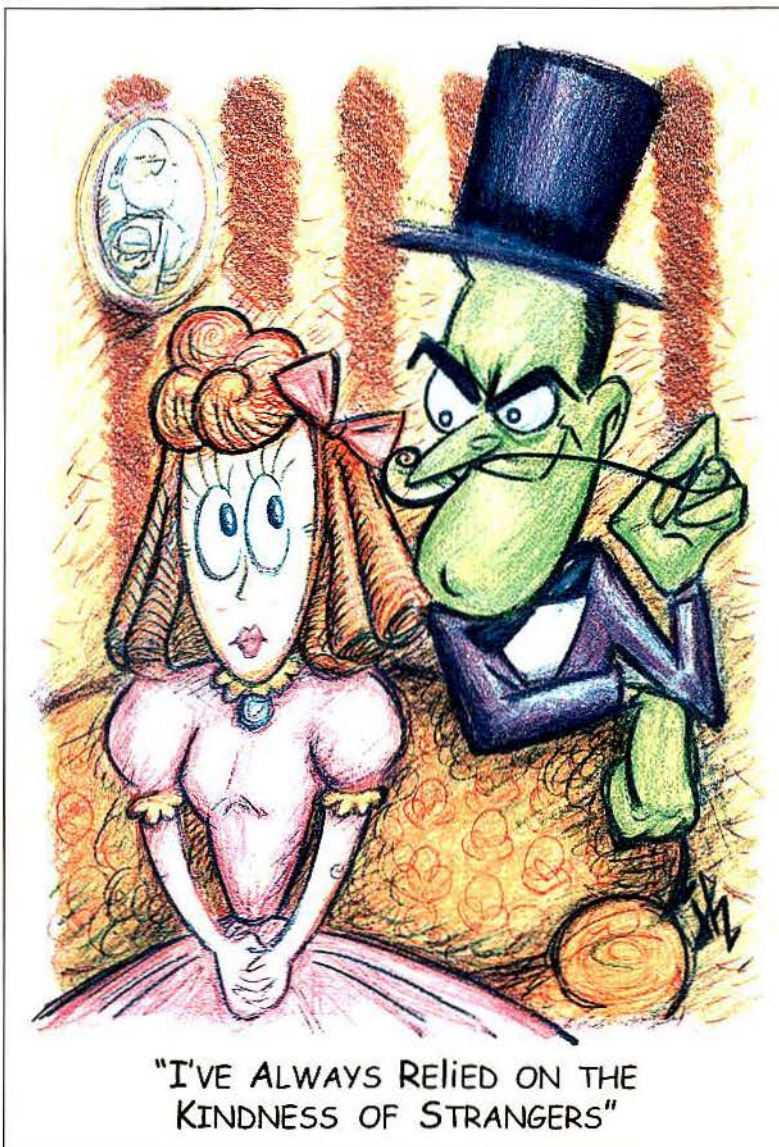


Illustration by John Hayes

companies like Nextel Communications. The information requested on those forms is *proprietary*, not required to be given or simply requested prematurely.

After you read the FCC's orders carefully, apply the stated requirements for EA licensees to your system. That is, see what the EA licensee would be required to do to relocate your channels in strict accord with the FCC rules. You



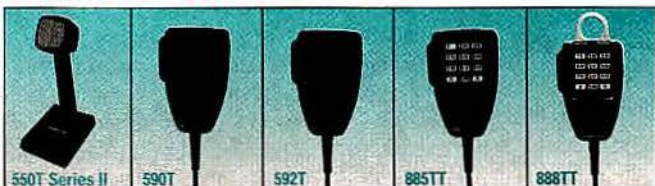
# ALL THE RIGHT CONNECTIONS.



more  
cordsets  
added!

Now compatible  
with even more radio transceivers!  
Including Ericsson MDX/Orion  
and Icom.

## MODULINK® SYSTEM 1



550T Series II

Transistorized base  
station with split-bar  
monitor transmit switch

590T

Transistor amplified  
dynamic

592T

Electret condenser  
with noise-canceling  
pick-up

885TT

DTMF with continuous-  
tone dialing and  
illuminated keypad

888TT

Aircraft DTMF,  
noise-canceling and  
FAA certified

Shure ModuLink® handheld microphones connect easily to virtually all popular radio transceivers with no hardwiring. Simply snap the correct cordset into the ModuLink microphone and the transceiver. And in just 30 seconds, you're ready to roll.

ModuLink® saves service time, reduces downtime and inventory costs, as well as all the quality you've come to expect from Shure.

For more information on how you can make all the right connections with Shure ModuLink System 1, call 1-800-25-SHURE.

**SHURE®**

The Sound of Professionals...Worldwide.®



formation perform a search of the FCC records to determine a number of factors, such as (1) whether the grant is under petition or objection; (2) whether any finder's preference targeting the channels is still pending; (3) the identity and location of any co-channel user; and (4) whether the FCC rules allow for relocating the channel to your location.

The last of those elements is quite important. Although the FCC has been clear in setting forth EA licensee's ability to engage, in relocation, the FCC has not significantly changed the rules for an EA licensee's operation of lower channels.

That is, the EA licensee was supposed to have constructed, made operational and continued provisioning service from systems employing those channels in accordance with any extended implementation schedule granted, if applicable. Of greatest importance, the FCC has not granted greater "mobility" in relocation of those channels. Therefore, the EA licensee will have to show that the channel can be moved and operated by you at your location.

Remember that relocation is really just a partial assignment of licenses granted to the EA licensee. Following

assignment, any special protections or privileges granted to the ESMR or EA licensee do not transfer to the site-based incumbent. Therefore, you must explore the licensing status of the channel before and after the assignment.

### Customers

The contract should articulate the way that customer units will be retuned or replaced. I've heard that one significant EA licensee is trying to reduce its burden by stating "We'll pay X dollars per customer unit for retuning." Depending on X, that offer might be a reasonable start. But there is also the issue of "downtime" of the customer vehicle during the retuning period. Will your customer get the value of downtime from the EA licensee? They should.

When equipment is incapable of being retuned, the issue of replacement comes up. The contract should address this issue and assure that the quality of replacement equipment is adequate to satisfy customers.

### General provisions

The contract to be negotiated between the parties can get quite complex, with an EA licensee providing a number of warranties. It can also be a simple matter, if you choose to simplify the process. But remember, the choice remains with the site-based incumbent licensees. They are entitled to have all terms, conditions, warranties, covenants and remedies spelled out in an agreement that demonstrates the EA licensee's duties. Like most things, it comes down to *trust*.

If you trust the EA licensee, then a simple agreement might fill the bill. If, however, you do not trust the EA licensee, you should protect your interests thoroughly by negotiating an agreement that speaks to each *who, what, where, when how and what-if* of relocation.

Despite what you might have heard, this is not a good situation to be rushed. Remember, if the EA licensee is unwilling or unable to provide seamless transition to comparable facilities and spectrum, the EA licensee is not entitled to force relocation. The burden is on the EA licensee to show the financial, regulatory and practical ability to engage in relocation. *The burden is not on site-based incumbents to show the contrary.*

Finally, despite claims to the contrary, there is no obligation to participate in binding arbitration. The matter is still before the FCC, and you can reasonably expect that this lawyer will keep telling the agency, "You started this, you finish it."

## Nothing Beats A...

### Quality Means Reliability ...

In today's marketplace, Diversified Electronics, Inc. stands out as the Quality Leader you can always depend on.

Call us for:

- ✓ Motorola Original Radios, Parts & Accessories,
- ✓ Motorola Mag One Line of Products,
- ✓ David Clark Headsets

When you have lives on the line you can't afford to take chances.

Buy the best and pay less from Diversified.

Visit Us On The Web At [www.diversifiedelectronics.com](http://www.diversifiedelectronics.com)



**DIVERSIFIED ELECTRONICS, INC.**

309-C Agnew Dr.

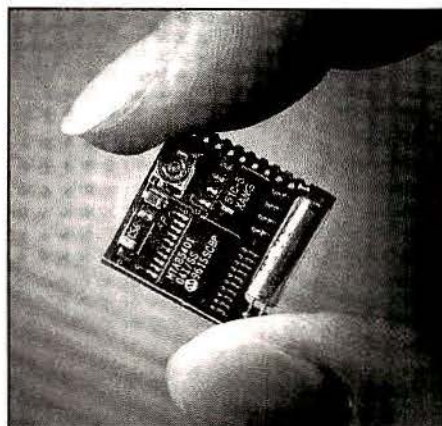
Forest Park, Georgia 30297

Toll Free: 1-800-646-7278 Ext. 144 Fax: (404) 361-6327 Ext. 144



Circle (14) on Fast Fact Card

## Digital ANI (Unit ID) Motorola® MDC-1200® Format



Micro-Minature ID-12

Manufactured by Control Signal®, the ID-12 ANI encoder is a cost-effective way to upgrade all the radios in your fleet with ANI that is compatible with Motorola MDC-1200. Works in all radios, and its tiny size (.59" x .65" x .12") allows it to fit in virtually all hand-holds. Has leading and trailing IDs, emergency, and time-out timer. Fleet price (100 qty) \$89 ea. Dealers: Call for pricing.

Call 800-521-2203

**CSC CONTROL SIGNAL**

1985 S. Depew, #7, Denver, CO 80227  
(303) 989-8000 FAX 303-989-8003  
[WWW.CONTROLSIGNAL.COM](http://WWW.CONTROLSIGNAL.COM)

Motorola and MDC-1200 are registered trademarks of Motorola Inc.

Circle (15) on Fast Fact Card



# ONLY ONE RADIO DISPATCH CONSOLE GIVES YOU UPGRADES, PROGRAMMING AND SUPPORT WITHOUT ALL THIS.



engineers, easily do the job.

Our revolutionary Customizer program helps you deal with future system changes by eliminating expensive and time consuming back-to-the-factory programming. The new MEDIC diagnostic application not only spots trouble, it recommends immediate corrective action thus saving time and

minimizing support costs.

Did we mention free upgrades? These are not only system upgrades they're also expanded capabilities and all new features. They're easily downloaded from the web.

The UltraCom NT is totally Y2K compliant. Watch for our new 9-1-1 product available in mid '99 and ask about our desktop systems and console furniture.

Don't shovel out precious resources unnecessarily. Choose the only system that's built to save a load of money.

Modular Communication Systems, Inc. 13309 Saticoy St. North Hollywood, CA 91605.

E-mail: [moducom@ix.netcom.com](mailto:moducom@ix.netcom.com)

See us at APCO National, August 8-12, Booth #533



**COST EFFECTIVE NOW.  
MORE COST EFFECTIVE OVER TIME.**



The costs of software upgrades, programming and support are immense and only our new UltraCom NT™ Console System can cut these costs. We spent over one million dollars developing a totally digital 32-bit Windows NT state-of-the-art system with fully programmable touch screens, system customizer and diagnostics built in. You never pay for system changes or trouble shooting. And even upgrades are free for the life of the system.

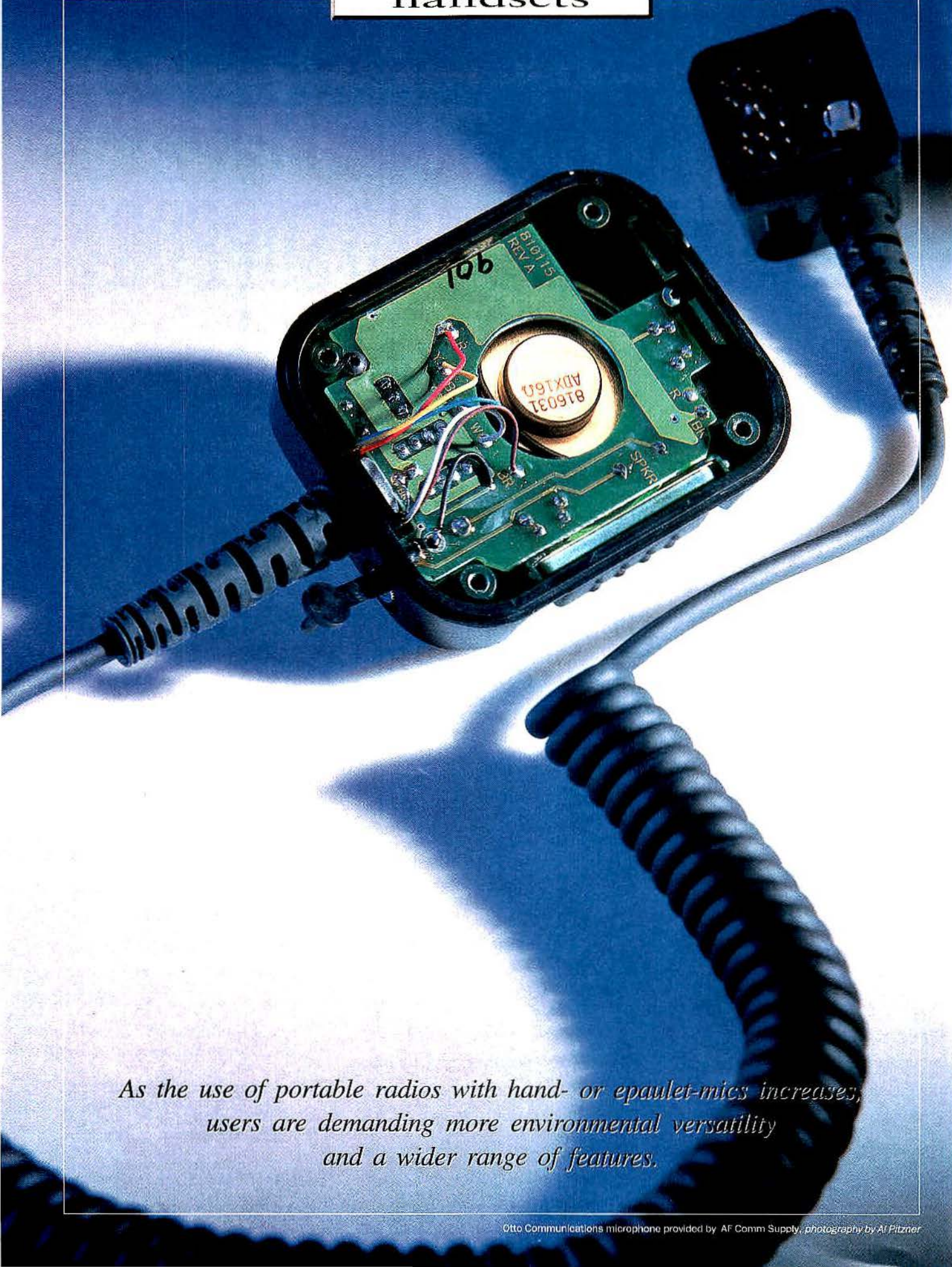
Our 20 years of experience went into developing the new Screenmaker. It's today's most flexible and fully programmable way to set up screens. When changes occur your technicians, instead of costly factory software

FREE DEMO SOFTWARE SYSTEM AT [WWW.MODUCOM.COM](http://WWW.MODUCOM.COM) OR 818-764-1333

Circle (16) on Fast Fact Card



## handsets



*As the use of portable radios with hand- or epaulet-mics increases, users are demanding more environmental versatility and a wider range of features.*



# Improving microphone technology

By Michael J. Major

**P**ersonal microphones used by public safety patrol and response officers are expected to work reliably in extremes of environment: raging forest fires, driving hurricanes and bitter cold. Mics must filter out high-decibel noises ranging from rock concerts to gunfire. Moreover, they are expected to be immune to radio frequency interference (RFI) and electromagnetic interference (EMI) and to be compatible with "incompatible" radios.

The wonder is not that mics don't always work to satisfaction, but that they work at all.

These devices *have* worked tolerably well, often under adverse conditions. That is shown by their ubiquity. Public safety officials constantly rely on portable radio systems. This, in turn, has driven manufacturers to work harder to come up new equipment. A number of manufacturers work in this arena, producing good microphones, but each has a different approach. No single "silver bullet" can solve all of the acoustical design problems associated with personal mics.

The way Television Equipment Associates, Brewster, NY, deals with problems such as RFI, EMI and radio

incompatibility is to customize each unit.

"Each problem must be dealt with on a case-by-base basis," said TEA Vice President Steve Tociłowski.

For instance, dynamic microphones

Shielding, noise  
cancelling, RFI chokes  
and capacitors and  
multi-directional devices  
are different solutions  
that may be appropriate  
in one situation  
but not in another.

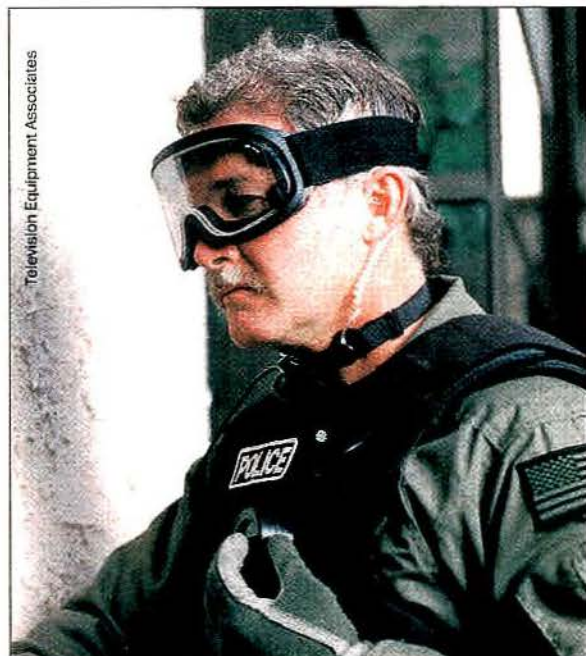
are used for military-type applications and electret mics are used for others. Dynamic mics withstand rugged use and typically have low impedance and a good

frequency response. A diaphragm fluctuates an attached coil in and out of a magnetic field, which induces electric currents in the coil. Low-distortion, high-frequency-response electret mics are similar to condenser-type mics, where a diaphragm is attached to one plate of a capacitor, except that electrets do not need a bias voltage to create an electric field. Dynamic mics have to be amplified to simulate electret mics. Each mic type is prone to different types of interference.

"The problems are not easily characterized, especially when the microphones are used in different environments," Tociłowski said. "And RFI is a very mysterious phenomenon to deal with. You often have to proceed through trial-and-error. It's not as if you have an empty tire that you simply fill up with air." Shielding, noise canceling, RFI chokes and capacitors and multi-directional devices are different solutions that may be appropriate in one situation but not in another.

Tociłowski said that TEA's mics had to be designed for different radios. "Each

Major is a communications writer based in Anacortes, WA.



Throat mics (below) and boom mics (right) are both popular for various environments and approaches in tactical situations.







Shure Brothers

Shure Brothers has a modular link series to solve the problem of microphone-to-radio incompatibility. The use of an appropriate module allows the user to plug into any radio without hardwiring. To meet the physical demands of public safety work, Shure microphones must pass 37 separate environmental tests, including exposure to extreme hot and cold temperatures, ultra-violet light, moisture and salt spray.

department generally tries to standardize its equipment, and as a manufacturer, we work with these interface problems," he said. "But it's also very common for public service departments to have more than one brand of radio—along with different models."

Evanston, IL-based Shure Brothers, on the other hand, has a modular link series to solve radio incompatibility.

single, biggest cause of microphone failure," Waller said. "This solution allows for the quickest resolution of this problem."

To meet the demands of ruggedness and reliability, Shure microphones must pass 37 environmental tests, Waller said, including exposure to extreme hot and cold temperatures, ultra-violet light, moisture and salt spray.

Applications Engineer Matt Waller said that Shure has a variety of port sets that can hook up to every radio.

"It's almost like a plug-and-play," Waller said, "Through the use of the appropriate module you can plug into any radio without the need of hard wiring."

Waller also said that modularity allowed a new cord to be added to a hand mic in seconds, avoiding downtime to send the cord and the mic to the repair shop, as is the case when the cord is hardwired to the mic.

"Cord failure is the

Gerald Bloom, president of Earmark, Hamden, CT, said that handling ambient noise was one of the design criteria for his company's products.

"We're a very specialized radio company and design only for environments others don't want to work in," Bloom said. "A few environments generate more noise that we can handle, but not many." He said that a front-to-back noise canceler erases, at a minimum, 12dB to 20dB and can be designed to cancel levels as high as 130dB.

The basic technology of enhancing the voice and filtering out unwanted sounds is well-known, Bloom said. The voice goes in one side while the other side cancels out the background noises. Bloom said that the geometry and design of the acoustic cavity, achieved through many years of research, has achieved a high level of efficiency.

Earmark has focused on fire and chemical hazard uses. The company offers a couple of options. One is an external mic that can hook onto the outside of a mask. The patented filtering device responds only to the human voice through special techniques involving nonlinear components used for differentiation. It acts as if the mask were not there. For use with SCBA equipment, like a

## ...and the award for Outstanding Performance in a Critical Role goes to...



**Mosaic™**

### MODULAR ANTENNAS

- **Simplifies purchasing.** Modular components reduce investment and inventory costs, while allowing for stocking flexibility
- **Improves performance** across all VHF and UHF channels
- **Choice** of patented Dura-Flex® spring or new cost effective springless model

**When performance really matters, turn to the communication specialists—Antenna Specialists.**



30500 Bruce Industrial Pkwy  
Cleveland, Ohio 44139-3996  
440-349-8400  
FAX: 440-349-8407

**800-664-5274**

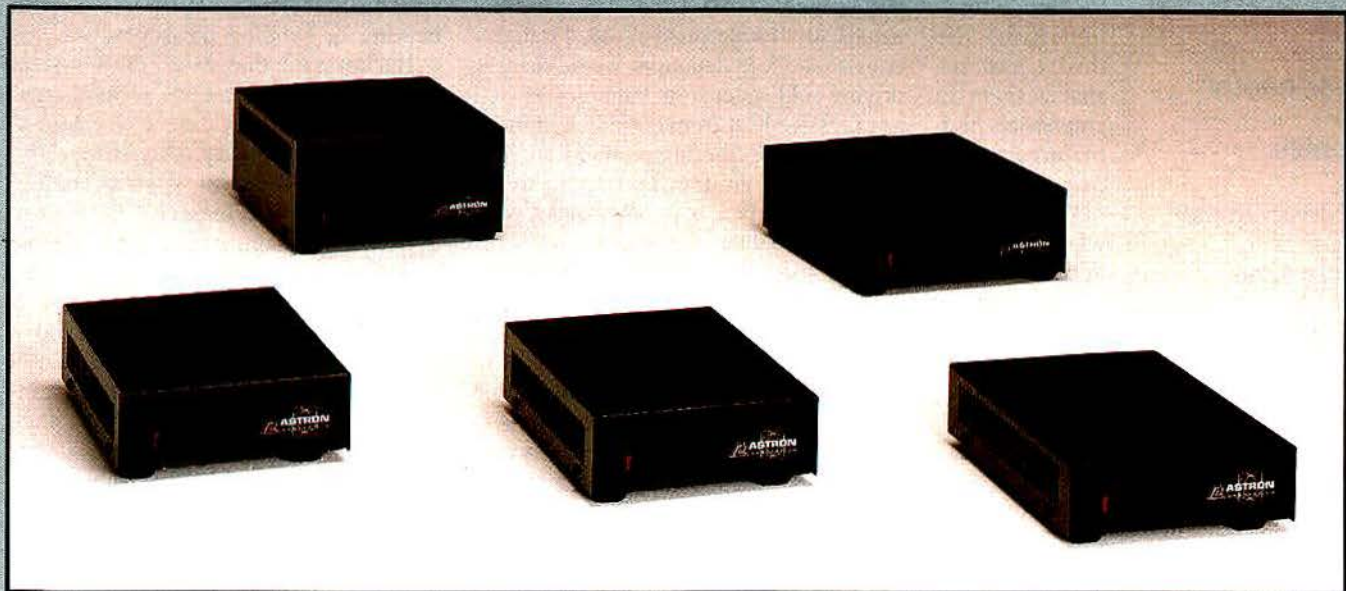
[www.allienteles.com](http://www.allienteles.com)



Circle (17) on Fast Fact Card



# ...POWER ON WITH ASTRON SWITCHING POWER SUPPLIES...



## SPECIAL FEATURES:

- HIGH EFFICIENCY SWITCHING TECHNOLOGY SPECIFICALLY FILTERED FOR USE WITH COMMUNICATIONS EQUIPMENT, FOR ALL FREQUENCIES INCLUDING **HF**.

- HEAVY DUTY DESIGN
- LOW PROFILE
- LIGHT WEIGHT PACKAGE
- EMI FILTER
- MEETS FCC CLASS B

## PROTECTION FEATURES:

- CURRENT LIMITING
- OVERVOLTAGE PROTECTION
- FUSE PROTECTION
- OVER TEMPERATURE SHUTDOWN

## SPECIFICATIONS:

INPUT VOLTAGE: 90-132 VAC 50/60 Hz OR  
180-264 VAC 50/60 Hz  
SWITCH SELECTABLE

OUTPUT VOLTAGE: 13.8 VDC

MODEL	CONT. AMP	ICS	SIZE (inches)	WT.(lbs.)
SS-10	7	10	2.3 x 6 x 9	3.2
SS-12	10	12	2.3 x 6 x 9	3.4
SS-18	15	18	2.3 x 6 x 9	3.6
SS-25	20	25	2 7/8 x 7 x 9 3/8	4.2
SS-30	25	30	3 3/4 x 7 x 9 5/8	5
SS-25M*	20	25	2 7/8 x 7 x 9 3/8	4.2
SS-30M*	25	30	3 3/4 x 7 x 9 5/8	5

- \*with separate volt and amp meters
- All SS power supplies are available in a **RACK MOUNT VERSION** (3.5 x 19 x 9 3/8)
- To order Rack Mount Version change SS to SRM (example: SRM-10)



9 Autry, Irvine, California 92618  
949-458-7277 Fax 949-458-0826  
[www.astroncorp.com](http://www.astroncorp.com)

Circle (18) on Fast Fact Card



**'The three conditions we design our microphones for are**

**environmental extremes, high noise levels and physical durability.'**

**-Karl Redmer  
Otto Engineering**

respirator, which hampers radio communication, Earmark uses the more traditional throat mic. This device picks up the low vibrations from the throat and reshapes them to emphasize high frequencies and cast off low frequencies, so what comes out approximates normal voice.

Karl Redmer, electrical engineering manager, Otto Communications, Carpentersville, IL, said that the

ing the mic case more difficult.

Redmer said that his company's products go through intensive focus group discussion and beta testing. Two difficult applications being dealt with include sealing the microphones against conditions such as driving rain, or hurricanes, so the water is kept out, but the voice audio emerges as loudly as possible against the background noise. Firefighters also work in situations where there is driving cold water from the hoses as well as excessive heat from burning buildings.

These noise-filtering products are also designed for air transportation ground crews, which face both noise and a wide range of weather conditions.

"The three conditions we design our microphones for are environmental extremes, high noise levels and physical durability," Redmer said. "They have to withstand shock treatment, and the cable has to be very rugged and remain flexible when it's subjected to abuse, such as being caught in a fence during a chase."

Redmer added that each microphone requires different sealants. "You can't simply close all the openings," he said. Microphones must incorporate subtle differences of design so that they can interface effectively with more than 100 types of portable radios.

Motorola Land Mobile Products Sector, Schaumburg, IL, has also developed a product designed "for the public safety professional who is often in an environment where it is difficult to communicate effectively and privately," said Charles Backof Jr., vice president. "Sirens, crowd noise and speeding traffic can interfere with hearing or sending messages."

Backof said that Motorola's system enhances communications in loud environments while providing a "speak-in-a-whisper" capability. An integrated microphone/receiver system, called CommPort, fastens securely onto the ear. Some "skull mikes," which pick up bone vibration, often suffer intelligibility because spoken fricatives (such as in words pronounced with an "f" or "s" sound—"fire" or "system") are not sufficiently sounded. Backof said Motorola's mic instead picked up sound waves as they crossed the face, enhancing voice quality.

Gail Moody, Motorola marketing manager, said that the company had put a lot of effort into ergonomics. Customer surveys, she said, have demonstrated that "Users want these microphones to be comfortable enough so they can wear them through an entire shift."

**ANOTHER**


# Amazing Story

**OF ZETRON**

## Versatility & Value

**"I'm impressed! We build a lot of repeaters and were looking for a small, inexpensive controller, something that would fit a wide variety of applications. Just a walkie talkie can access and program the 37-MAX remotely and it has Morse ID. They're easily installed on just about any radio."**

**Bob Barnett, President  
Barnett Electronics,  
Lonoke, AR**



**Model 37-MAX**

**This Model 37-MAX community repeater panel has advanced features not available on other repeater controllers in its price range. Features like squelch-tail elimination, reserve tone mode, ToneLock high-performance decoding and more. The Model 37-MAX Repeater Pal supports a tremendous base of 154 users—(50 CTCSS, 104 DCS) at possibly the best value in the industry. Call Zetron today for a great deal on a quantity order of the 37-MAX Repeater Pal and the full line of advanced repeater controllers and interconnect equipment. And if you want to hear an amazing repeater system in the Lonoke area, talk to Bob Barnett.**

**ZETRON®**

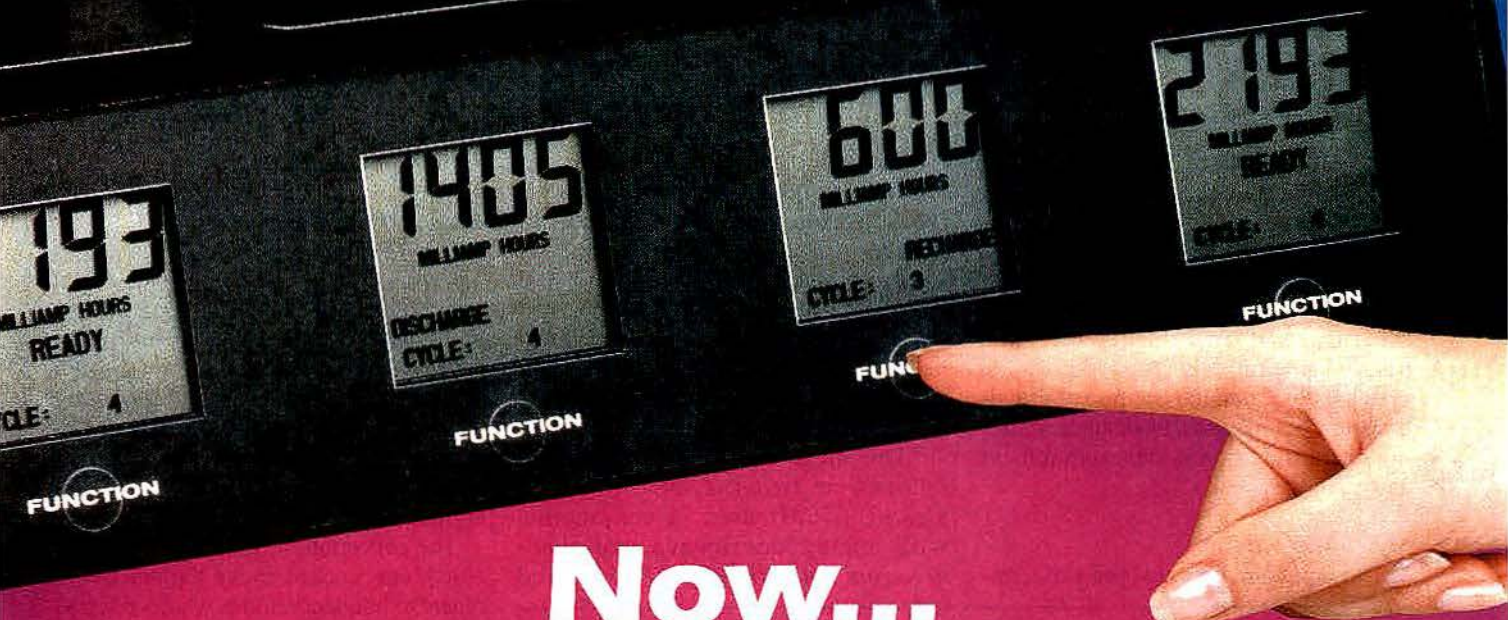
Zetron, Inc. PO Box 97004, Redmond WA 98073-9704 USA

Ph: (425) 820-6363 Fax: (425) 820-7031 Email: [zetron@zetron.com](mailto:zetron@zetron.com) Web: <http://www.zetron.com>

European Office: Zetron, Inc. 27-29 Campbell Court, Bramley, TADLEY, Basingstoke, RG26 5EG, UK Phone: +44 1256 880683 Fax: +44 1256 880491



# It's a "NO BRAINER" Battery Analyzer & Conditioner



## Now... at your fingertip!

**Easy-To-Use... "Just one Button" gives you access to the most technically advanced and affordable analyzer/conditioner on the market today!**

The Analyzer I, III & VI Series has standard features not found on other systems costing over three times as much...including:

- Charges & analyzes Nickel-Cadmium, Nickel Metal Hydride, Lead Acid & certain Lithium Ion chemistries.
- Single button operation.
- Four independent charge rates.
- Eight independent discharge rates.
- Computer compatible.
- Interchangeable adapter cups.
- UL, CSA & CE approved.

Call for our comprehensive detailed catalog



**W&W Manufacturing Co.**

800 South Broadway, Hicksville, NY 11801

In U.S. & Canada 800-221-0732 • In NY 516-942-0011 Fax 516-942-1944  
E-Mail: [w-wassoc@ix.netcom.com](mailto:w-wassoc@ix.netcom.com) • Web Site: <http://www.wwassociates.com>

W&W Europe B.V. Phone: +31(0) 172-417072 • Fax: +31(0) 172-417080

Circle (20) on Fast Fact Card



WHERE QUALITY IS #1



# Controlling base stations over microwave

*New wireless applications have caused increased demand for base station and circuit transport equipment. Circuit voice frequency and signaling schemes are necessary in implementing any remote radio system controlled over microwave.*

By Jeff Ashley

Remote-controlling two-way base stations has been commonplace for decades. Various radio system configurations demand differing control and transmission requirements. Microwave systems are a popular method of circuit transport but require a basic understanding of transmission systems equipment and practices.

## Microwave radios

The input and output signals of a mi-

crowave radio are not directly compatible with discrete two-way radios. Microwave radios provide a method of transport for many circuits at a time—sometimes up to several thousand. The signals carried by the microwave system are a composite, containing information from all combined active circuits. The combining process is called *multiplexing*. (See Figure 1 below.)

The most common multiplexing schemes are *frequency-division multiplexing (FDM)* used in conjunction with analog microwave and *time-division multiplexing (TDM)* used

with digital microwave.

## Analog multiplex equipment

FDM equipment essentially slices up a portion of the HF frequency spectrum into a series of channel slots, each 4kHz wide. Every circuit in the multiplex (mux) system is assigned its own unique slot. Through the multiplexing process, translation and filtering methods convert each circuit into a single-sideband suppressed carrier (SSBSC) signal.

The collection of SSBSC signals (circuits), one stacked above the other with regard to frequency, forms what is referred to as the *baseband*. The composite baseband signal is applied to, and modulates, an FM microwave transmitter.

Although common carriers use analog microwave links that support thousands of circuits, industrial microwave applications typically do not carry more than 600 channels, and often fewer. Direct-to-line FDM equipment can be purchased on a per-channel basis to accommodate smaller systems in a cost-effective manner.

## Digital multiplex equipment

TDM is a digital process that converts discrete circuits into a single serial bit stream. The most commonly used scheme in the United States is to convert 24 circuits into a 1.544Mbps data stream, referred to as a *T1*. Such a T1 multiplexer is often referred to as a *channel bank*. The composite 1.544Mbps signal allows each circuit a maximum data rate of 64kbps, which is considerably greater than what is required for voice and radio applications.

Currently, digital microwave radios can transport from as few as one T1 to

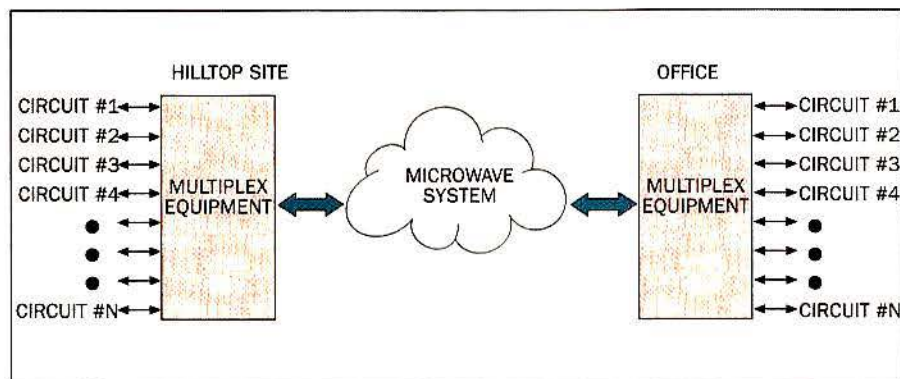


Figure 1. Individual circuits interface to the microwave system through multiplex equipment.

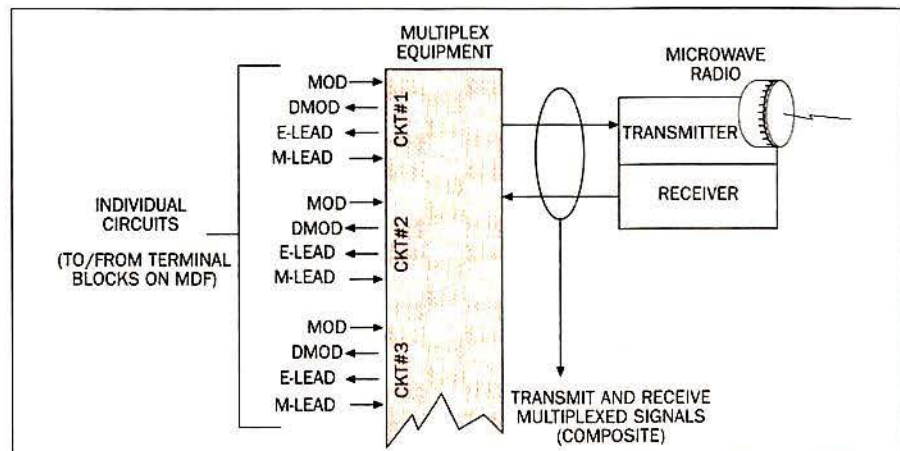


Figure 2. The voice frequency (VF) and signaling information for each circuit is multiplexed into a single, composite, four-wire signal.

Ashley is a communications technician in Los Angeles.





When you need full-featured, quality Uniden radio equipment at competitive prices, call Hutton Communications. Hutton is an authorized distributor of Uniden two-way radios, accessories and parts for radio dealers across the U.S.

## RELY ON HUTTON FOR UNIDEN RADIO PRODUCTS!



Hutton's network of sales and warehouse facilities provides fast delivery of Uniden radio products. And Hutton stocks all the other equipment, from antennas to power supplies, that you need to support your Uniden sales.

Uniden continues to be a leader in conventional and trunked radios for a wide-range of applications. For Uniden product information or to place an order, contact your nearest Hutton branch location.

You can rely on Hutton for Uniden radio products!



The  
First  
Choice  
in  
Wireless  
Distribution

Hutton Communications, Inc.

**888-348-8866**

[www.huttoncom.com](http://www.huttoncom.com)

Circle (21) on Fast Fact Card

Atlanta  
Denver

Calgary  
Harrisburg

Chicago  
Seattle

Dallas  
Toronto



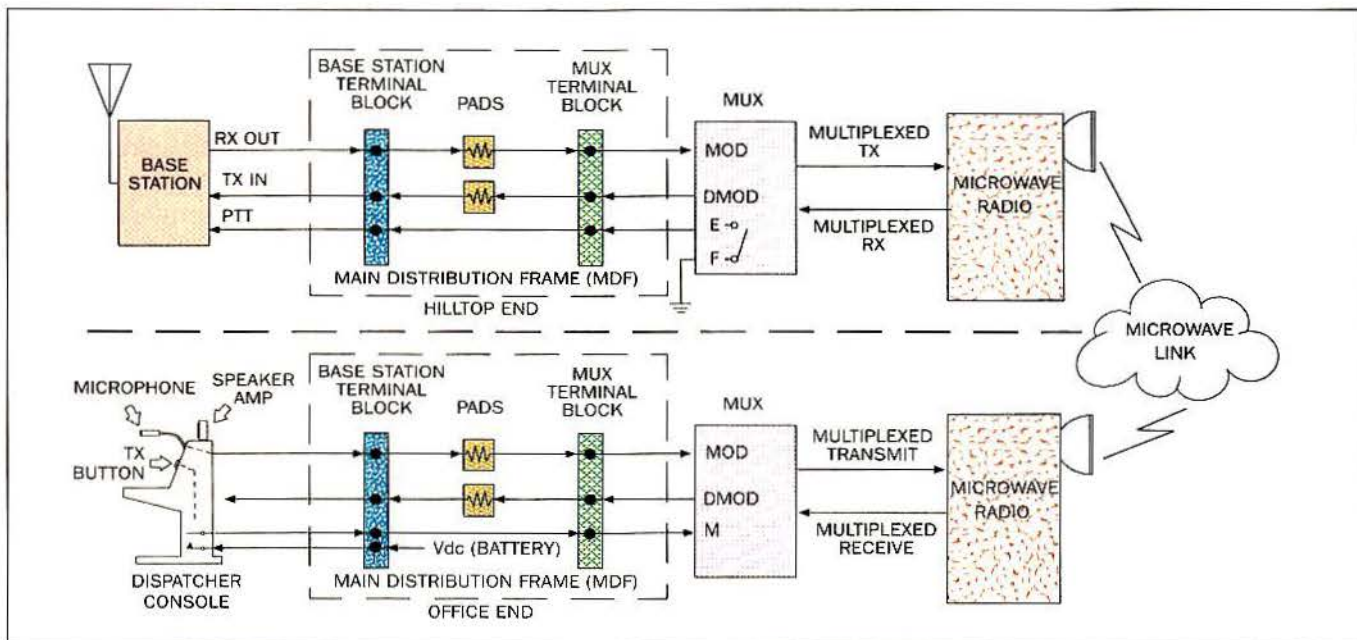


Figure 3. A typical remote base station circuit using four-wire, E & M mux.

more than a hundred. As the system capacity increases, so do the required microwave transmission data rate and bandwidth.

#### Voice frequencies (VF)

Whether the multiplexing scheme is FDM or TDM, a mux channel modem is

required on both ends of each circuit. For radio applications, the modem is the point of termination for the base station on the hilltop, and the controlling equipment (such as a dispatch console) in the main office.

Each mux channel has a VF (audio) response of about 300Hz to 3,400Hz.

The mux channel VF receive and transmit connections are referred to as the DMOD and MOD (respectively). They offer a balanced, 600Ω, two-wire (2W) or four-wire (4W) connection to the associated equipment.

The microwave and mux equipment operate in a full-duplex mode. This



# There Is No Competition

## When you need RF Power Amplifiers

Leadership by tradition.

# TPL

COMMUNICATIONS

3370 San Fernando Road, #206 • Los Angeles, CA 90065-1437 - USA  
(323) 256-3000 • (800) HI POWER • FAX (323) 254-3210  
Email: electronic@compuserve.com

Circle (22) on Fast Fact Card



# Advanced Battery Care - Plain and Simple

The **IQ<sup>ten</sup>** delivers speed and flexibility.

## Programmable Power and Flexibility Without the Programming Effort

Each of **five battery test stations** is programmed via bar code to test and refurbish the battery with unrivaled speed and accuracy. Enough flexible control and charge/discharge power for batteries with ever-increasing capacities and changing chemistries.



## Simplicity of Operation

- 1: Scan the battery test code.
- 2: Periodically check the printer and pull "test reports."
- 3: Use the reports to pull batteries for re-use or rejection.

## Affordable Expansion

The IQ<sup>ten</sup> system networks up to 80 batteries on one RCU and printer. A significant battery care program at affordable prices.



Contact  
**iTECH**

9454 Waples Street  
San Diego, CA 92121  
800-233-6868 option 2  
619-458-1500 ext. 2102

[www.itecheng.com](http://www.itecheng.com)

iTECH (Intelligent Technologies) is the leading supplier of OEM battery test systems.

©1999 Intelligent Technologies LLC. The iTECH logo and IQ<sup>ten</sup> logo are registered trademarks of Intelligent Technologies LLC.

Made in USA.

**itech**  
Intelligent Technologies



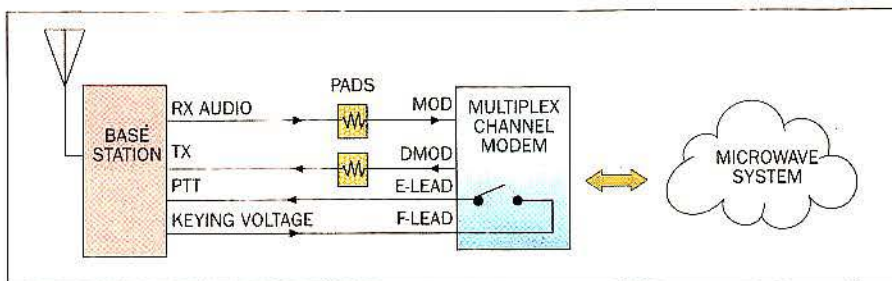


Figure 4. Occasionally, a base station application will require a specific internal keying voltage to be routed through the mux receive signaling leads.

means the transmit and receive functions are active at the same time. Used in conjunction with full-duplex base

stations and user-end equipment, radio-telephone interconnect companies can provide customers with services that al-

low them to listen and to speak at the same time.

## VF levels

Although mux modems operate over a wide range of VF levels, good engineering practice dictates that the maximum transmission level, referred to as *test tone level*, should not be exceeded. Test tone level at the DMOD and MOD of the mux modem are +7dBm and -16dBm, respectively.

Excessive levels are a greater consideration with analog mux and microwave equipment because much of the signal processing requires circuitry to be operating in a linear mode. When levels become excessive, circuitry can be driven into non-linear operation, resulting in intermodulation distortion.

Transmission systems engineers often use the term *dBm0* to express the power level of a signal at a particular point in a circuit, referenced to test tone level. For example, if a tone level of 0dBm is measured at the mux channel DMOD, the level can be expressed as either 7dB below test tone level, or just simply -7dBm0. (Remember, test tone level at the DMOD is +7dBm.)

The VF levels of each mux channel modem can be altered by means of variable receive and transmit gain adjustments or internal pad strapping options. For the sake of standardization, mux levels are often set identically for each circuit within the *same application* (i.e., all radio circuits may be operated at -10dBm0 while all data circuits operate at -13dBm0, etc.). In such cases, any level variations required by different equipment within the same application are accommodated by the use of *external pads*.

## Signaling

Most circuit applications also require the transmission and reception of supervisory information to perform a particular function related to circuit operation. In a phone circuit, supervisory information may indicate an off-hook condition to the central office, while in a radio circuit, it may activate a transmitter. The transmission and reception of supervisory information within a circuit is achieved by means of *signaling*.

*In-band signaling* is accomplished by use of one or more frequency specific tones that fall within the VF pass-band of the mux channel. Presence or absence of a particular tone frequency within the circuit activates or deactivates the needed function. For example, tone remote base stations use a specific in-band tone signaling scheme that can

# PASSPORT<sup>®</sup> & NTS<sup>®</sup>

The world's  
most  
powerful  
SMR  
network solution.

**PASSPORT<sup>®</sup>** is Trident's enhanced trunked networking protocol. Now available in radios from leading radio manufacturers.

**NTS<sup>®</sup>** (Network Trunking System) from Trident Micro Systems is a build-as-you-go network infrastructure. The digital distributed network architecture provides maximum user capacity. **NTS<sup>®</sup>** provides a ready migration path to digital.

## Features:

- 60,000 ID Codes Per System
- Automatic Roaming and Check-in
- Wide Area Dispatch Operation
- Unique ESX Per Radio
- 128 Sites Per Network
- Selective Calling Within a System
- HOT Swappable Plug-in Cards
- Exclusive CyberTune System Set-up



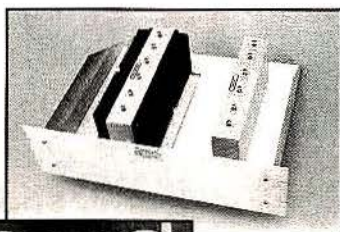
**TRIDENT**  
MICRO SYSTEMS

Two Trident Drive, Arden, North Carolina, 28704  
Phone (828) 684-7474 • (800) 798-7881 • Fax (828) 684-7874  
www.tridentms.com • sales@tridentms.com

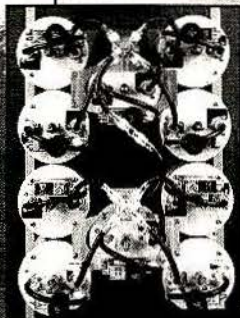


# "COMING THROUGH LOUD AND CLEAR"

- Wattmeters
- Combiners
- Duplexers
- Antennas
- Filters
- Systems



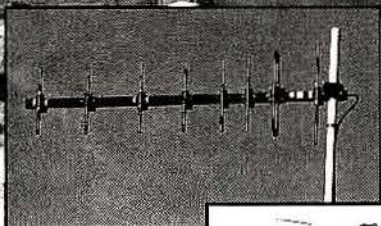
Telewave, Inc. delivers  
high performance  
everytime, everywhere.



We bring 26 years of product  
and system design experience  
to the table for every customer,  
large or small, worldwide.

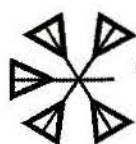


With a full line of standard  
products, and custom designs  
available for special projects,  
our support of Public Safety,  
Government, and Business  
systems is second to none.



Contact Telewave today at  
**1-800-331-3396** and discuss  
your system requirements  
with our sales engineers.  
Or visit our website at  
**[www.telewave.com](http://www.telewave.com)**

Telewave, Inc.  
1155 Terra Bella Avenue  
Mountain View, CA 94043  
email: [sales@telewave.com](mailto:sales@telewave.com)



**TELEWAVE, INC.**

Wireless Communications Manufacturers Since 1972





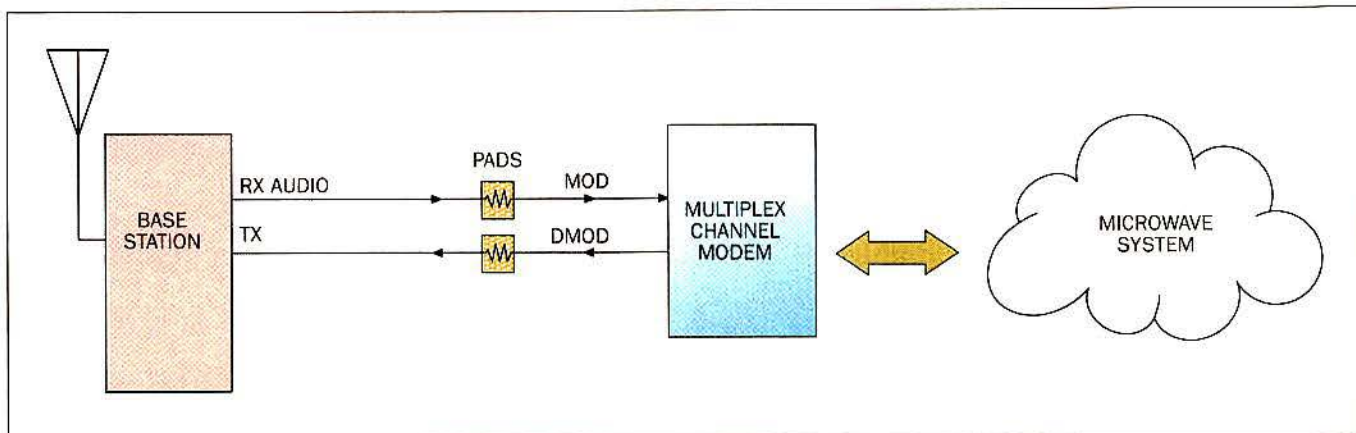


Figure 5. In-band signaling schemes do not require the use of mux channels E- and M-leads.

activate a transmitter, change operating channels and disable receive CTCSS decoder functions.

*Out-of-band signaling* is achieved by transmitting and receiving supervisory information over the circuit, but from outside the normal VF passband. In FDM systems, out-of-band signaling is accomplished by insertion of a signal on either the edge of the channel's frequency slot or within the slot but outside the VF passband (such as a 3,825Hz tone). Presence or absence of the signal determines the state of the supervisory function. In TDM systems, signaling is

determined by the logic state of dedicated signaling bits.

Whether analog or digital mux is used, a mux modem has two primary connections dedicated for signaling functions. These are referred to as the *E-lead* and the *M-lead*. The M-lead is the transmit signaling lead. When the mux modem M-lead is activated, signaling is transmitted to the far-end of the circuit. Reception of the far-end M-lead activates the local E-lead. Digital mux has the capability of providing two E- and M-leads, which proves to be advantageous in certain applications, as

shown in Figure 8 on page 36.

#### Main distribution frame (MDF)

The VF and E- and M-lead connections from each circuit are cabled from the mux equipment rack to terminal blocks, typically located on the inside wall of the site. Most signal-carrying site equipment (including any external pads) is cabled to the same general location. The collection of all equipment terminal blocks can then be found in the same portion of the building, on the same wall and is referred to as the *main distribution frame (MDF)*. With all

**YOU HAVE INVESTED MILLIONS ...  
... YOU WANT TO KNOW WHERE THEY ARE?**

**GPS Vehicle Location • Display Terminals • Software Integration**

925-122 S. Semoran Blvd.  
Winter Park, FL 32792  
800-327-9956 US Only  
407-679-9440  
www.ceswireless.com

**CES**  
WIRELESS TECHNOLOGIES

Circle (26) on Fast Fact Card

**COMPLETE  
SURGE  
PROTECTION  
PACKAGE FOR:**

- AC Power UL 1449 2nd Edition
- T1/ E1 lines.
- COAXIAL lines N, 7/16 DIN, TNC, SMA...

*Ideal  
for Radio,  
Wireless and  
Cellular base  
stations.*

**CITEL**  
1-800-CITEL-4U  
1111 Park Centre Blvd., #340  
Miami, FL 33169  
(305) 621-0022 • Fax (305) 621-0766  
Visit us on the internet at:  
http://www.citelprotection.com  
e mail: citel4u@ix.netcom.com

Circle (27) on Fast Fact Card Visit us at UTC, Booth #827



# The New Motorola Radio is Now Complete

Introducing add-on  
voice privacy for the  
Motorola HT Series  
Portable Radios



## VOICE PRIVACY

Call Now for Details

1-800-276-8878

or 402-474-4800





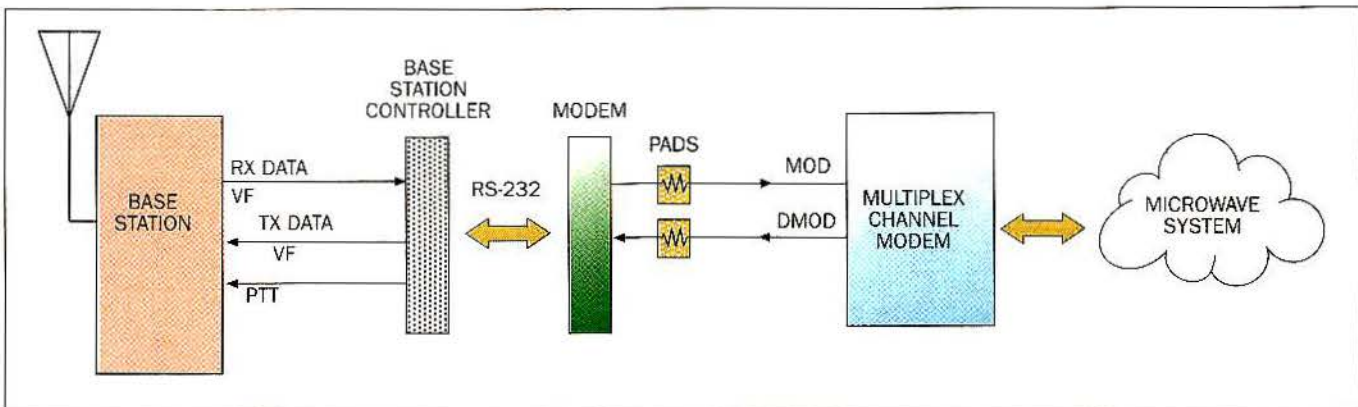


Figure 6. The signaling information in a data radio system is contained within the data itself.

equipment signal connections available in one location, jumpers (referred to as cross-connects) can be made from one piece of equipment to another by connecting wires between the respective blocks. In this manner, the mux channels are cross-connected to their respective pads and base stations.

#### Multiplexed signal connections

FDM systems require coaxial cables to carry the multiplexed receive and transmit baseband signals between the multiplex equipment and the microwave radio.

On the other hand, T1 signals can use


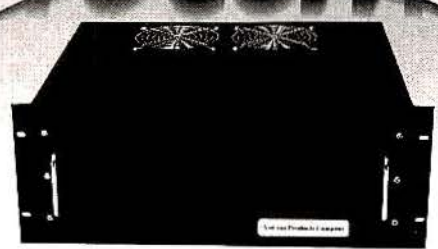
inexpensive telephone wire (twisted pair). (See Figure 2 on page 24.) Cable specifically designed for higher data rate applications, such as Category V, allow spanning of greater distances between the mux and microwave equipment. It is a good practice to have the transmit and receive pairs on separate cables, or at least in separate bundles if the same cable is used.

#### Practical applications

Figure 3 on page 26 offers an example of a remote-controlled base station using E- and M-lead signaling. Here, the dispatcher can press a button

on the console to key the hilltop transmitter. The button causes switch contacts to close routing battery voltage to the mux channel M-lead. Activation of the M-lead is detected on the hilltop end, causing a contact closure of the hilltop mux channel E-lead relay. The E-lead relay contacts apply a ground to the base station PTT line, keying the transmitter.


As the dispatcher speaks into the microphone, voice audio leaves the console and, after appropriate padding, is applied to the mux channel MOD. The voice is recovered on the hilltop-end from the mux channel DMOD and then



## RF POWER AMPLIFIERS

MODELS AVAILABLE:

- ◆ VHF 130-175 MHz to 500 watts output
- ◆ 230-280 MHz to 100 watts output
- ◆ UHF 400-512 MHz to 350 watts output
- ◆ 800-960 MHz to 200 watts output



847-593-1213  
FAX 847-593-1320  
sales@vocomrf.com  
www.vocomrf.com

Circle (29) on Fast Fact Card

## EASY ANTENNA MEASUREMENTS

### Using VSWR BRIDGES



High Accuracy Without Cal Routine  
Immune to +30 dbm Interference  
Replaceable Center Pins  
Coverage to 3.0 GHz  
Low Cost: \$629  
5 Watt Power

The simple addition of an EAGLE VSWR bridge to your Spectrum Analyzer/Tracking Generator allows quick and easy antenna system measurements. Why spend thousands for a handheld device when you have most of the solution already?



Sweep of Antenna System

**PLEASE call for FREE application note:**  
**"Antenna and Feed-line Measurements"**  


VOICE: (520) 204-2597    email: eag@sedona.net  
 FAX: (520) 204-2568    Box 4300 Sedona, AZ 86340

Circle (30) on Fast Fact Card



# A Product Line You Can Bank On!

## LTR® Controllers

For all UHF/800/900 LTR systems.

**LT-4200** For LTR® dispatch operation. Also serves as validator for other brands of controllers on the LTR® bus.

**LT-4900** For LTR® dispatch & interconnect operation. Comes standard with EE, DID, E&M; compandor; CSIBASE and more.



## Repeater Tone Panels

Worlds leading supplier!

**TP-163** Brings you more tones/codes and features than any other shared dispatch panel. DTMF and computer programmable. Low cost.

**TP-154** 154 tones/codes for shared dispatch. Loaded with features. DTMF programmable. Low cost.

**TP-154-PLUS** 154 tones/codes for shared dispatch & interconnect. Comes with Speed dialer; Three digit over dial of CTCSS, DCS, DTMF, 2 Tone and 5/6 Tone signalling codes, and more.



## Interconnects

We've led the way for 16 years!

**8300** Repeater, Duplex Interconnect & Dial Access Paging for private systems. Comes with Speed dialer; Three digit over dial of CTCSS, DCS, DTMF, 2 Tone and 5/6 Tone signalling codes, and operates on any one of 154 tones/codes.

**CS-900** Control Station Interconnect. Has Digital voice delay, Speed-dialer and more. Export version available. Low cost.

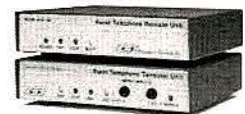
**CS-800** Duplex interconnect with built-in repeater maker. Speed dialer and more. Low cost.

**9800** Provides selectable interconnect mode; Control Station, Half Duplex or Sampling. Has built-in Repeater maker; DTMF, CTCSS, 2 Tone, and 5/6 Tone signalling; Speed dialer and more.



## Rural Telephone

**RT8 System** Allows an ordinary tone/pulse telephone set to operate wireless at a remote location. (RF equipment not included).



## Communications Decoders

**CD-2** Decodes and displays; 51 CTCSS, 112 DCS and 16 DTMF's. Has serial port and optional data management software for your PC.

**LT-2** Decodes all LTR® data. Displays User ID, home channel and DTMF. Has serial port and optional data management software for your PC.



## Phone/Radio Remote

**6800** Allows use of base control station (even trunked) from all in-plant keyset or PBX telephones.



To learn more about our line call  
Ray Dashner toll free **800-545-1349**



**Connect Systems Inc.**

2259 Portola Rd.  
Ventura, CA. 93003

Phone  
FAX  
Email  
Website

(805) 642-7184  
(805) 642-7271  
sales@connectsystems.com  
www.connectsystems.com  
(product info online)

CSI is a registered trademark of Connect Systems Inc. LTR is a registered trademark of EF Johnson Company.

Circle (31) on Fast Fact Card



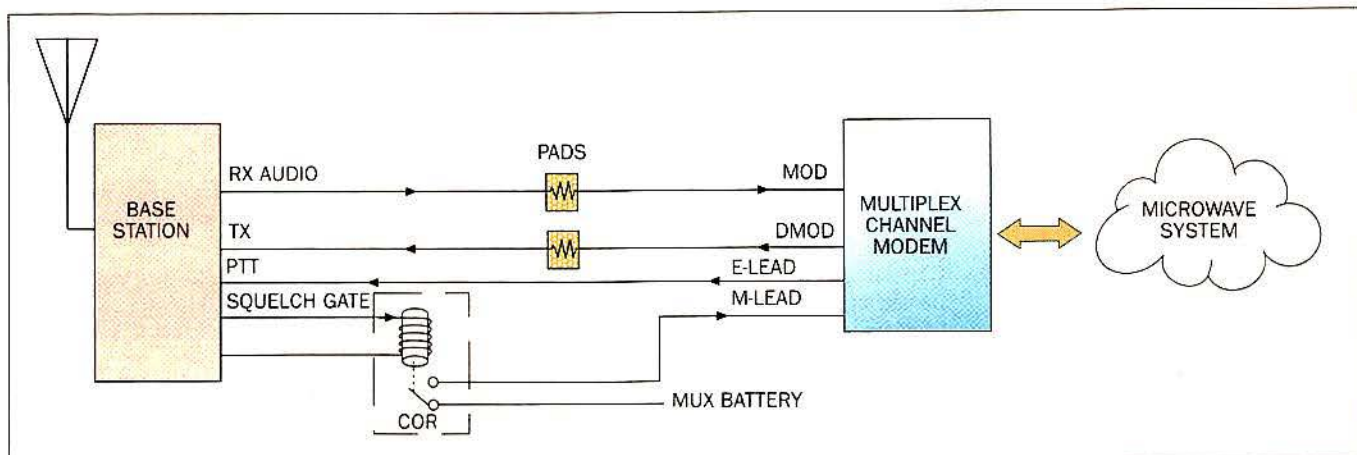


Figure 7. E & M signaling can be used to relate receiver squelch gate status to the control point.

routed through a pad to the base station exciter. Because the transmitter has been keyed, the dispatcher's voice will now be broadcast over-the-air. If a radio transmission from a mobile or portable field unit is received by the hilltop base station, it is routed through the receiver to a pad, then on to the mux MOD connections. The recovered signal is delivered from the DMOD of the office-end mux, through a pad to the console speaker amp. The dispatcher now hears what is being received by the hilltop radio.

Some base stations may require a specific keying voltage that originates within the radio itself. Figure 4 on page 28 illustrates such a situation. On receipt of signaling from the dispatcher, the voltage obtained from the base station is routed into the mux channel F-lead, then back out the E-lead to the radio PTT line.

Tone-remote base stations are common. Figure 5 on page 30 shows the hilltop end of such a circuit. Signaling functions such as keying, channel switching and disabling the receiver

CTCSS decode function are accomplished through the use of different tone frequencies. The tones are contained within the normal passband of the circuit and therefore do not require use of E- or M-leads.

Figure 6 on page 32 is an example of a remote-controlled data radio. As in the previous example, E & M-Leads are not necessary because the supervisory information is embedded within the data being transported. The hilltop mux modem receives data originating from the host computer on the office-end.

## TRANSMITTER LOCATION

New fixed site direction finders provide 2 degree accuracy, and include software for triangulation from a central control site. Mobile versions also available covering 50MHz to 1 GHz

**Doppler Systems Inc.**  
PO Box 2780 Carefree, AZ 85377  
Tel: (602) 488-9755 Fax: (602) 488-1295  
www.dopsys.com

European Marketing Director Denis Egan  
PO Box 2, Seaton, Devon EX12 2YS England  
Tel & Fax: 44 1297 62 56 90

Circle (32) on Fast Fact Card

## Wind Power!

### Enhance your PV system

**Benefits:**  
Power night and day  
Reduce seasonal fluctuations  
Reduce total system costs  
Reduce operational costs

**Monthly Average Output:**  
9 mph average: 15.7 kWh  
10 mph average: 22.3 kWh  
11 mph average: 29.6 kWh

**Specifications:**  
Rated 300 watts  
Only 14 lbs (6.3 kg)  
45 inch (1.14 m) blade dia.  
Only two moving parts  
Internally regulated  
**3 year warranty**

**AIR Industrial**  
Let us explain the benefits of wind power.  
(800) 946-3313 Ext. 53

Southwest Windpower  
2131 N. First St.  
Flagstaff, AZ 86004 USA  
Tel (520) 779-9463 Ext. 53  
Fax (520) 779-1485  
www.windenergy.com  
dept53@windenergy.com

Circle (33) on Fast Fact Card



# For All Your Flexible Coax Needs



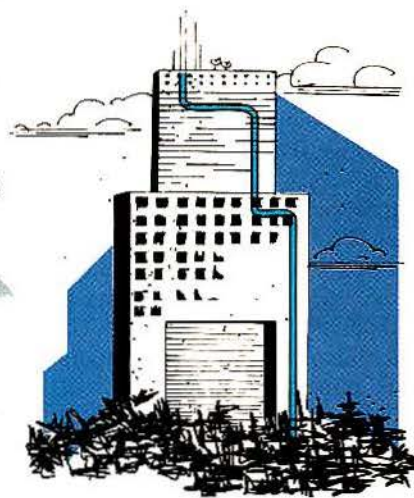
*In Building Communications*



*Distributed Communications*



*Wireless Data*



*Building Top  
Wireless Cellular/PCS/WLL/LMDS*

## ***TIMES Microwave has it:***

- **LMR®** Flexible Low Loss Coax
- **LMR®-DB** Flexible Watertight Coax
- **LMR®-FR** Riser Rated Coax (UL/NEC 'CATVR', CSA)
- **LMR®-FR-DB** Watertight Riser Rated Coax (UL/NEC 'CATVR', CSA)
- **LMR®-LLPL** Plenum Rated Coax (UL/NEC 'CATVP', CSA)
- **nu-TRAC®** Radiating Cable
- **Nu-RAD** Radiating Cable
- EZ Install (non-solder) Connectors
- Hardware Accessories



*For a free catalog call or  
visit our web site.*



**TIMES** MICROWAVE SYSTEMS  
A Smiths Industries company



World Headquarters: 358 Hall Avenue, Wallingford, CT 06492 ■ 203-949-8400, 1-800-867-2629 FAX: 203-949-8423  
International Sales: 4 School Brae, Dysart, Kirkcaldy, Fife, Scotland KY1 2XB UK ■ +44(0)1592655428 FAX: +44(0)1592653162  
[www.timesmicrowave.com](http://www.timesmicrowave.com)

Circle (34) on Fast Fact Card



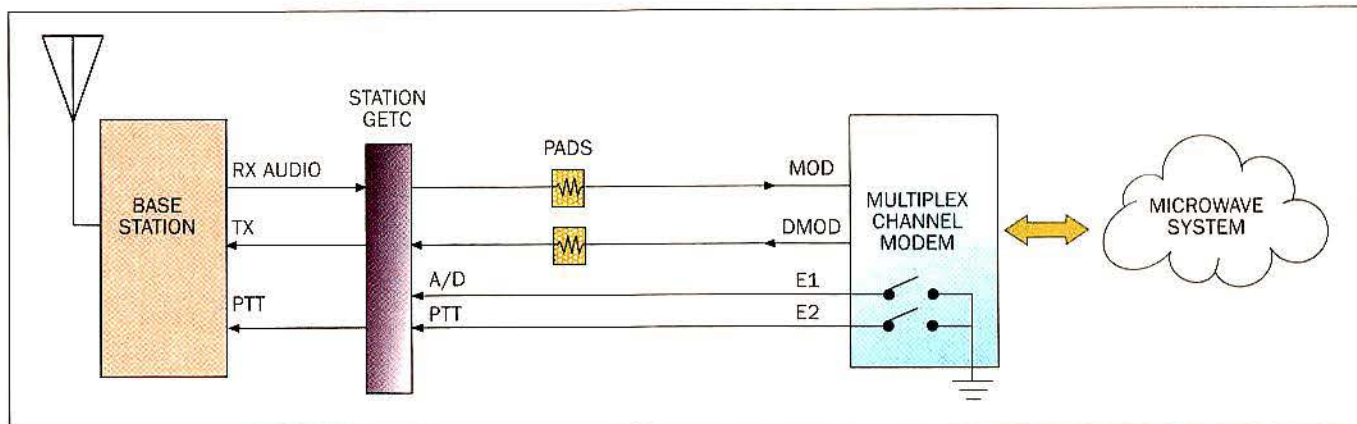


Figure 8. An EDACS simulcast system uses multiple signaling leads.

The VF DMOD signal is padded, then applied to the receive side of a 4W data modem. The modem converts the analog VF receive data signal to a digital (usually RS-232) format. The digital data is then cabled to the base station controller (BSC). The BSC develops a PTT function from the receive data signal and deviates the transmitter with an analog data modulation scheme. The transmitted data is received by mobile data units in the field. In the uplink direction, recovered data from mobiles and portables in the field is sent back to the BSC, modem, pad and mux MOD.

The multiplexed data transmission is transported back to the office host computer via microwave.

The most common scheme for transmitting the hilltop receiver squelch gate status back to the office is through the use of a status tone. Since typical status tone frequencies of 2,175Hz and 1,950Hz fall within the bandpass of a mux circuit, the use of E- and M-leads is unnecessary. It is possible however, to accomplish the same thing with E- and M-leads, as shown in Figure 7 on page 34. The active squelch gate voltage level must be compatible with the

mux channel M-lead operating voltage range. This is often *not* the case and a Carrier Operated Relay (COR) must be added between the base station and the M-lead to convert the voltage levels appropriately. The COR is activated when the base station receiver unsquelches. Battery from the mux is routed through the COR contacts and applied to the M-lead. Activation of the hilltop M-lead in turn operates the office-end E-lead. The office-end E-lead connection can be run to an E and M style voter or used simply to light a lamp on the dispatcher console indicating receiver

## 100 AMPS CONTINUOUS



### MB 100M Power Supply from DuraComm

13.8 VDC Output Rated at 100 amps continuous duty in a package that fits a standard rack, is only 3 1/2" tall and meets "half rack" depth requirements.

- 3 Other Models available, starting at 40 Amps Continuous
- Modular, expandable construction
- Dual thermostatically controlled cooling fans
- Battery back-up module available for UPS

Join DuraComm in the switch-mode revolution!  
Contact your communications distributor  
or call or fax us Toll Free.

Phone 1-800-467-6741 Fax 1-800-825-1403

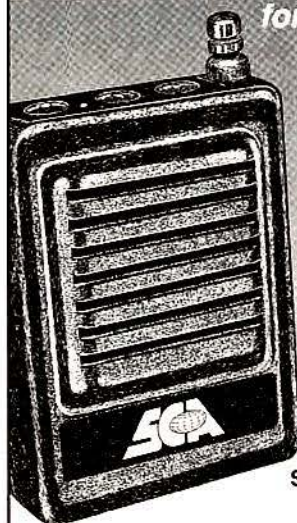


203 W. 23rd Ave.  
North Kansas City, MO. 64116  
On the Web at [www.duracomm.com](http://www.duracomm.com)  
e-mail: [duracomm@duracomm.com](mailto:duracomm@duracomm.com)

Circle (35) on Fast Fact Card

## TONE AND VOICE SCEPTAR

Providing Tone and Voice Pagers  
for over twenty years



### Features:

- Synthesized, PC Programmable
- 2-Channel Operation
- Multi-Address Format
- Channel Monitoring Capability
- Vibrate Option
- Small Size—3-1/8" x 2-7/16" x 3/4"
- Single "AA" Battery
- 2-3 Year Limited Warranty Available



Shinwa Communications of America Inc.  
P.O. Box 26407  
Oklahoma City, OK 73126

ORDER TOLL FREE: 1-800-627-4722  
FAX TOLL FREE 1-800-759-1722

Circle (36) on Fast Fact Card



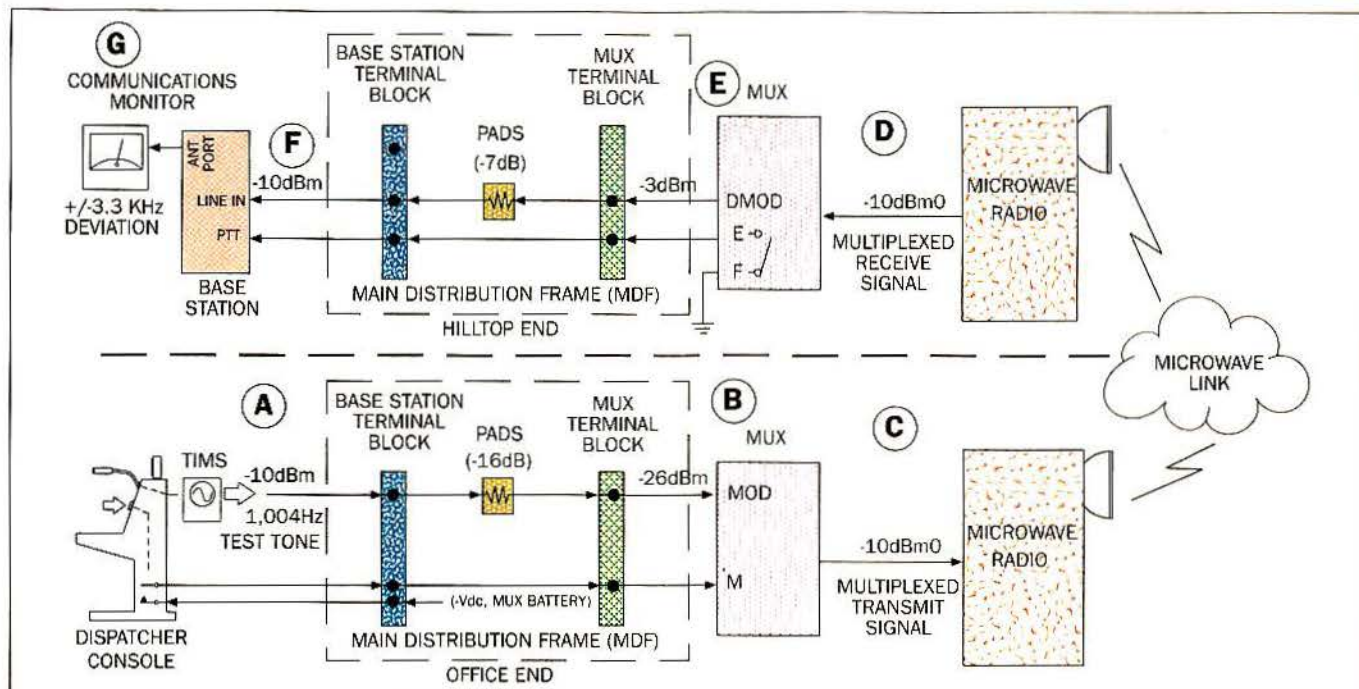


Figure 9. Setting transmitter levels through the system.

activity for that hilltop.

Figure 8 on page 36 is a simplified illustration of the VF and signaling connections for a simulcast EDACS trunking system. This application uses a mux modem with two E-leads. One E-lead is

used to key the transmitter (PTT), while the other switches the station GETC between analog and digital modes (A/D).

#### Circuit level alignment

Circuit level alignment should be

performed not only after the circuit is first installed, but also periodically to ensure proper performance. The most common piece of test equipment used in the VF alignment process is a transmission impairment measuring set

## Receive Weather Alerts Automatically

on your 2-way radio system, PA system, voice-mail, numeric pager or telephone!

- Rack-mount and mobile systems
- Warnings digitally recorded for DTMF access and playback
- Designed specially for demanding Public Safety use

Call toll free 1-888-877-8022  
or visit our Web site at:  
<http://www.thuneagle.com>



U.S. Patents 5,444,433 - 5,574,999 - D,377,795

Circle (37) on Fast Fact Card

## PARTNER TO YOUR SUCCESS

COMPLETE LINE OF PRODUCTS  
FOR YOUR  
**COMMUNICATION SYSTEM**

ANTENNAS, FILTERS AND SITE MONITORING

200 MHz

400 MHz

800/900 MHz

DIPOLAS  
OMNIS  
YAGIS

TX COMBINERS

RX MULTICOUPLERS  
DUPLEXERS

davicom  
technologies

1.877.327.4832  
(609) 653.1065  
[www.davicom.com](http://www.davicom.com)

Circle (38) on Fast Fact Card



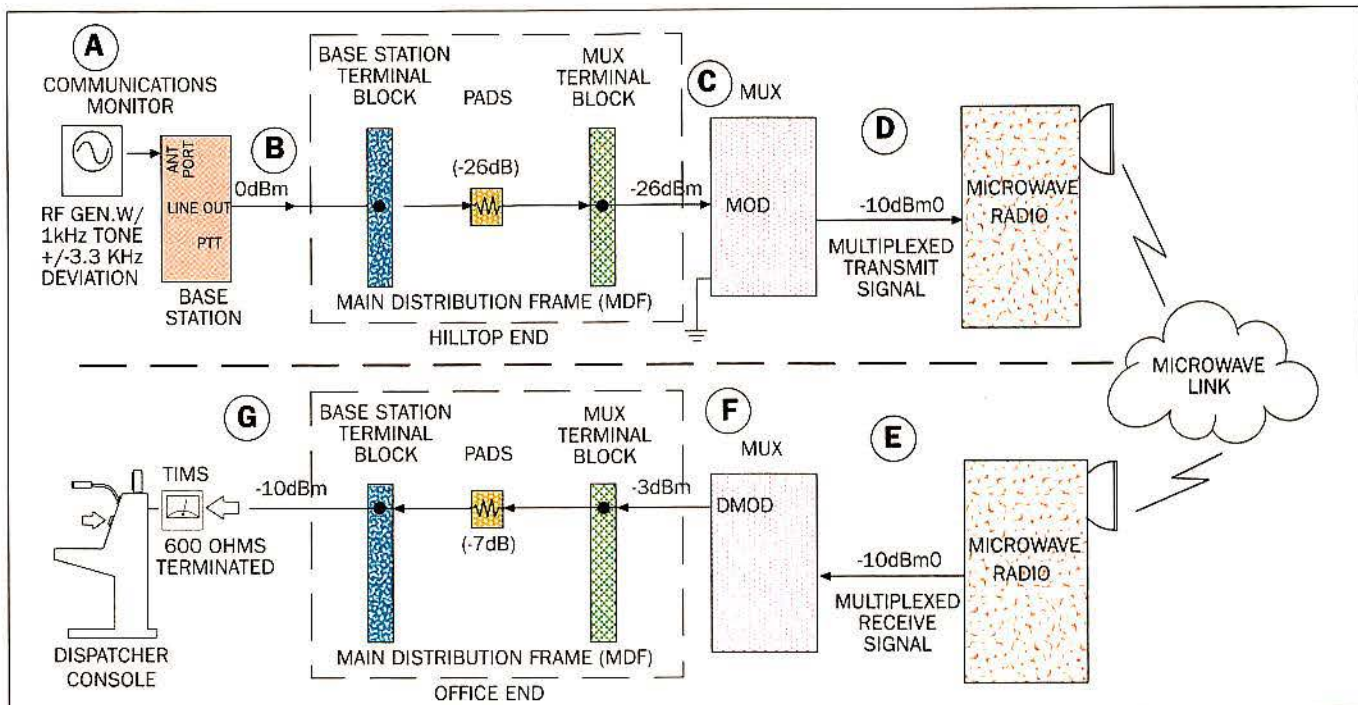


Figure 10. Setting receiver levels through the system.

(TIMS). This device transmits VF tones over a wide range of frequencies and levels. In its receive mode, it offers critical measurement of tone levels and frequencies in several impedances, bridge-

ing or terminating. The more sophisticated TIMS can run circuit parameter tests such as impulse noise, signal-to-noise ratio, noise-to-ground, PAR, distortion and others.

Figure 9 on page 37 and Figure 10 above illustrate a 4W, E and M mux circuit between a dispatch office and a hilltop. The letters A through G indicate test points at which level measurements can be made. Actual circuit levels may vary, depending upon the application, however these figures serve as a general example of how and where to make level measurements from one end of the circuit to the other.

Figures 9 and 10 assume that the dispatch console is set up to send and receive a maximum level of 0dBm, with average voice levels being 10dB lower (-10dBm0). Using a constant-level test tone makes the alignment process much easier than with signals such as voice that vary significantly with time. For this reason, the circuit is broken at the output of the console and a TIMS is inserted to inject a -10dBm (-10dBm0) tone at point A.

The typical frequency sent by a TIMS for circuit testing and alignment is 1,004Hz. This tone is sent to the mux channel MOD, via a -16dB pad. The pad adjusts the level to hit the MOD at -26dBm. Because test tone level at the MOD is -16dBm, the -26dBm tone level is still -10dBm0 (10dB below test tone level). This -10dBm0 level is maintained throughout the length of the circuit. The tone level at point B should be verified with a TIMS. If the TIMS is clipped across the balanced pair (paralleled) it should be set to the *bridging* mode. It is placed in the *terminating* mode if the circuit is broken and con-

# Need Remotes?



## Call us.



**DC Remotes**  
**DC Termination Panels**  
**Tone Remotes**  
**Tone Termination Panels**  
**Local Extensions**  
**Multi-Channel Remotes**



941 Hensley Lane • Wylie, TX 75098  
Voice (800) 869-9128 • Fax (888) 437-5360

Circle (39) on Fast Fact Card



nected directly into the TMS.

When the dispatch console transmit button is pressed, battery voltage is applied to the mux channel M-lead to activate signaling. A dc voltmeter can be used to verify presence of the signaling voltage at the M-lead connection (Point B).

The tone is then multiplexed through digital or analog methods. Because the signal at point C is multiplexed, a TMS will be of no value to verify VF tone levels. If FDM (analog) equipment is used, and the channel baseband frequency slot is known, a frequency selective level meter (SLM) can make the level measurement. On the other hand, if TDM (digital) equipment is used, a T1 tester with DS0 drop and monitor capabilities can be used. Presence or absence of circuit signaling may be verified with these same test instruments. VF level discrepancies should be eliminated by adjusting the mux channel MOD level adjustment.

The multiplexed signal is injected into the microwave radio and transmitted to the hilltop. Once received at the hilltop, the multiplexed circuit VF tone level (point D) may again be verified using the same means as at point C. If the tone has not maintained the -10dBm0 level, the discrepancy is being introduced by the microwave radio equipment and should be corrected. This is a likely scenario with analog microwave equipment. The transmit deviation may be incorrect on one end, or the receiver demodulator output level may be wrong on the other. Adjustments can be accomplished within the microwave radios to correct these problems. This type of level discrepancy should not occur when using a digital microwave equipment, however. Here, VF levels within multiplexed circuits are a function of the multiplex equipment only.

At the hilltop mux DMOD (point E), a level of -3dBm should be realized to maintain the -10dBm0 circuit levels. A -7dB pad reduces the tone level to provide compatibility with the particular base station line input level requirements (in this case -10dBm). The base station antenna port should be terminated into a communications monitor to check the transmitter deviation level without broadcasting the test tone over-the-air. Transmitter keying is accomplished when the office-end M-lead is detected by the hilltop E-lead circuitry. Activation of the hilltop E-lead applies a ground to the PTT line, keying the base station.

The communications monitor is set to the base station transmit frequency.

The modulated tone level should result in  $\frac{2}{3}$  of the maximum allowable deviation when the transmitter is keyed. Discrepancies in transmit deviation levels are eliminated by adjustment of a line input level or exciter level adjustment within the base station itself.

Figures 9 and 10 illustrate transmitter deviation of  $\pm 3.3$ kHz, which assumes the maximum transmitter deviation is  $\pm 5$ kHz. The maximum transmitter deviation adjustment should be set prior to the circuit alignment process.

This completes the alignment process in one direction only. Figure 10 shows how alignment would be accomplished in the opposite direction. The communications monitor is set to the base station receive frequency and put into the signal generate mode. Modulated with a 1kHz tone to  $\frac{2}{3}$  maximum deviation ( $\pm 3.3$ kHz), sufficient RF signal (typically 1,000 $\mu$ V) is injected into the receiver to produce a clean sounding tone with no audible noise.

A TMS (in the bridging mode) can be clipped across the balanced pair at point B to verify the tone level out of the receiver. The line output level adjustment of the base station should be set for 0dBm. The tone is then sent through a pad to adjust the level for -10dBm0 at the MOD (an absolute level of -26dBm), which can be verified by a TMS at point C. Once multiplexed, the tone may be monitored at point D by a SLM or T1 tester with DS0 drop and monitor capabilities, depending on whether analog or digital mux is used. The multiplexed signal is injected into the microwave transmitter and transported to the office-end.

After being demodulated through the microwave receiver on the office-end, the multiplexed signal at point E can once again be checked for proper levels, as at point D. The output of the mux channel DMOD can be adjusted to produce a -10dBm0 signal (-3dBm) while monitoring with a TMS at point F. Finally, the tone is padded appropriately to hit the terminated TMS at the level required for proper console operation (-10dBm).

### Summary

Emergence of new wireless applications has resulted in increased demand for both base station and circuit transport equipment. A complete understanding of how these and existing remote systems operate not only requires knowledge of two-way radio but transmission systems as well. Familiarity with circuit VF and signaling schemes is basic to the successful implementation of any remote radio system controlled over microwave. ■

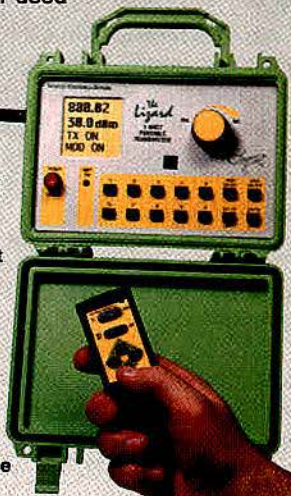
## Berkeley's Newest Indoor Transmitter & Receiver

*The Lizard*  
1 WATT

### PORTABLE TRANSMITTER

A portable, battery-powered 1 watt transmitter used for indoor coverage testing.

- Self-contained module design
- 1 milliwatt to 1 watt output
- Remote control
- 128 x 128 graphic LCD with backlight
- Removable battery



13 STANDARD FREQUENCIES  
IMMEDIATELY AVAILABLE!



## MONGOOSE

### HAND HELD RECEIVER

A light weight receiver that's ideal for quick indoor sweeps by propagators.

- Internal memory stores signal strength that can be output to a PC with a serial cable
- Large graphic EL backlit display allows user to view any 3 channels simultaneously
- Rechargeable Ni-Cad Battery
- Audio can be heard through headphone jack or an internal speaker
- Available in most popular frequency formats
- Weighs under 5 lbs. (including battery)



**BERKELEY  
VARITRONICS SYSTEMS**

Call us today for more information:

732-548-3737 / Fax: (732) 548-3404

Internet: [www.bvsystems.com](http://www.bvsystems.com)

E-mail: [info@bvsystems.com](mailto:info@bvsystems.com)

Circle (40) on Fast Fact Card



# Product/logo directory

For more information on the following advertisers in this issue, circle the corresponding Fast Fact number on page 69.

## AEA

AEA offers a cable analyzer for minor impedance variations for cable lengths of zero to 4,800 ft with the TF-3120 precision Step TDR featuring a 1.2GHz. [www.aea-wireless.com](http://www.aea-wireless.com)

Circle (301) on Fast Fact Card

## Berkeley Varitronics Systems

Berkeley Varitronics Systems designs and manufactures test and measurement equipment for the wireless communication industry and has 28 models of propagation and transmission test instruments available.

Circle (302) on Fast Fact Card

## Chase Systems

Chase Systems provides product and services related to EMF/RF safety, including RF field analyzers, personal protection monitors, RF protective clothing, site safety surveys and training.

Circle (303) on Fast Fact Card

## Citel

Citel manufactures a complete line of surge protectors for ac power, data and RF coaxial lines, and surge arrester gas tube components also.

Circle (304) on Fast Fact Card



## Communications Specialists

Communications Specialists' tone signaling products include CTCSS, DPL and two-tone sequential encoders and decoders, shared repeater tone panels, SMD prototype kits,

narrowband filter kits and ANI.

Circle (305) on Fast Fact Card

## Connect Systems

Connect Systems offers new LTD trunking controllers that have expanded the product line of community repeater controllers, telephone interconnects, ANI readers and communications decoders.

[www.connectsystems.com](http://www.connectsystems.com)

Circle (306) on Fast Fact Card

## Daniels Electronics

Daniels Electronics manufactures fixed and portable radio base stations and repeaters for two-way voice, trunking, mobile data, cross band, and paging applications.

Circle (307) on Fast Fact Card

## DAPA Communications

DAPA's line of more than 200 antennas features combinations of linear and dual-band/slant 45 polarized, omni-directional and other configuration antennas for 806MHz-960MHz and 1,710MHz-1,990MHz.

Circle (308) on Fast Fact Card

## Dataradio

Dataradio is a designer, developer and manufacturer of radio modems and infrastructure for private wireless computing networks and provides turnkey, open-architecture wireless mobile data systems for fleet users.

Circle (309) on Fast Fact Card

## Davicom Technologies

Davicom Technologies offers a full line of filter, antenna and monitoring products. Dealer inquiries are welcome. Call toll-free 877-327-4832 in the USA; 800-

465-4343 in Canada.

Circle (310) on Fast Fact Card

## Doppler Systems

Doppler Systems offers the 5900 series direction finder. It features remote display, coverage of 50MHz-1,000MHz, 5° bearing accuracy, digital processing and high-intensity display for daylight viewing.

Circle (311) on Fast Fact Card



## EFJohnson

EFJohnson manufactures conventional and trunked radio products, including LTR-Net 9800 Series Mobile. The series is interoperable with existing LTR, and can expand single or multisite subscriber networks. [www.efjohnson.com](http://www.efjohnson.com)

Circle (312) on Fast Fact Card

## EMR

EMR provides design, supply and implementation of complete RF communications systems including isolators, RX multicouplers, cavity resonators, duplexers, TX combiners, amplifiers and antenna site engineering. 800-796-2875.

Circle (313) on Fast Fact Card



The First Choice in Wireless Distribution

## Hutton Communications

Hutton Communications distributes wireless communications products from more than 125 manufacturers of site infrastructure products, radio communications equipment, power systems products and test shop equipment.

Circle (314) on Fast Fact Card



## iTech

iTech offers battery testing

with the IQten programmable battery test system offering 100mA-2A of power on all five stations. 800-233-6868, ext. 2102, [www.itecheng.com](http://www.itecheng.com)

Circle (315) on Fast Fact Card



## Modular Communications Systems

Modular Communications Systems designs radio dispatch console systems. The Ultracom NT dispatch console is a digital, 32-bit system with programmable touch screens, system customizer and diagnostics included.

Circle (316) on Fast Fact Card



## Motorola

The Motorola R2600 series of communication systems analyzers tests analog and digital two-way radio systems. The platform provides support for IDEN, MPT1327/1343, Motorola analog trunking. [www.AccessSecure-mot.com/Accesspoint](http://www.AccessSecure-mot.com/Accesspoint)

Circle (317) on Fast Fact Card



## Ritron

Ritron manufactures a complete line of land mobile radio products including portables mobiles, repeaters, data telemetry modules and accessories for worldwide distribution.

Circle (318) on Fast Fact Card

## SCA

SCA is leading the market in tone/voice paging. Along with tone/voice, it has extended its line to include POCSAG digital paging.

Circle (319) on Fast Fact Card



## Shure

Shure's 810 speaker micro-



phone, part of the Modulink system of interchangeable microphones and cords, provides sound performance and reliability even in foul weather.

Circle (320) on Fast Fact Card

### Telepath

Telepath is a provider of two-way radio and wireless communications products specializing in two-way business communications. [www.tele-pathcorp.com](http://www.tele-pathcorp.com)

Circle (321) on Fast Fact Card

### Thunder Eagle

Thunder Eagle is a designer, manufacturer and distributor of weather alert radios for emergency management and other professional users. [www.thuneagle.com](http://www.thuneagle.com)

Circle (322) on Fast Fact Card



Times Microwave Systems  
Times Microwave Systems

specializes in the design and manufacturing of high-performance, flexible and semi-rigid coaxial cable, connectors and assemblies for RF transmission from HF through microwave frequencies.

Circle (323) on Fast Fact Card

### TPL Communications

TPL Communications is a manufacturer of RF power amplifiers, VHF low band through UHF high band for mobile, base station/repeater applications.

Circle (324) on Fast Fact Card



### TX RX

TX RX provides multi-couplers, combiners, signal boosters, antennas, tower-mounted preamplifiers, duplexers, filters and other RF system products for use in the 100MHz to 1GHz range.

Circle (325) on Fast Fact Card

### Vega

Vega manufactures specialized radio/telephone dispatched control consoles and associated base station adapter panels, as well as audio processors, audio amplifiers and tone encoder or decoder.

[www.vega-signaling.com](http://www.vega-signaling.com)

Circle (326) on Fast Fact Card



### Vertex Standard

With experience in land mobile radio, Vertex Standard offers a wide variety of public safety equipment from cross-band repeaters to public safety portables and mobiles.

Circle (327) on Fast Fact Card



W&W Manufacturing  
W&W Manufacturing

manufactures two-way radio replacement batteries, chargers and analyzer/conditioners. More than 200 charger and analyzer adapter cups are available for land mobile radios, cellular phones and laptops.

Circle (328) on Fast Fact Card



### Zetron

Zetron designs, manufactures and markets more than 100 wireless communications systems, including radio and telephone consoles, paging systems, trunked radio, SCADA and telemetry, utility networks and land mobile radio.

Circle (329) on Fast Fact Card

Visit our Web site at  
[www.mrtmag.com](http://www.mrtmag.com)

## got data? need wireless?

- License-free 900MHz and 2.4GHz Spread Spectrum Radio Modems
- VHF/UHF Radio Modems
- RS232 and RS485 Interfaces (2 and 4 wire available)
- Point-to-point and Multi-point Systems
- Radio Modem Boards for OEM Applications
- Pole Mountable Amplifiers for Spread Spectrum Radios

Complete Systems Available: Cables, Antennas, and Accessories!!!

888-297-9090

**YDI** [www.ydi.com](http://www.ydi.com)

Circle (41) on Fast Fact Card

## Fire Pager with Monitor

(Reconditioned)

\$135



- ☒ Durable Motorola KeyNote® pager
  - ☒ Reconditioned to factory specifications
  - ☒ We add our unique Monitor Adaptor - Pager functions the same as a Minitor II® in Monitor mode
  - ☒ 90 Day Warranty with optional extended warranty
  - ☒ Price below is on **Your Frequency** and programmed to **Your Paging Tones**
- |                          |                           |
|--------------------------|---------------------------|
| 1 - 20 units \$135 each  | 51 - 100 units \$122 each |
| 21 - 50 units \$128 each | over 100 units \$115 each |

**800-822-2180**

Fax: 561-683-0059

International: 561-683-0022

**P&W** Paging and Wireless Service Center

1300 N FL Mango Rd #26  
West Palm Beach, FL 33409

<http://www.pwservice.com>



**Wanted: Minitor II Pagers**

## Minitor II Repair

- \*Minitor II Repair just \$29.50
- \*Price includes all Parts & Labor
- \*Water/Physical Damage and housing parts not included

Minitor II and KeyNote are a reg. trademark of Motorola Inc

Circle (42) on Fast Fact Card





# Watch out for Y2K

*We're not going to tell you again: Jan. 1, 2000, is looming around the corner. Agencies and companies not actively fixing their systems should be making contingency plans. The FCC finds medium-sized public safety entities and service providers are most at risk.*

By Nikki Chandler

January 1, 2000, is inexorably approaching. While the public is wondering if it will have electricity or enough drinking water (or which party to go to), the FCC is wondering if the wireless telecommunications industry will be ready for Y2K. With only five months to go, agencies and companies that have not reached compliance yet (and especially those that don't even *have* a plan yet) should be preparing contingency plans. Even an agency close to 100% Y2K compliance should not overlook contingencies. The magnitude of the problem (more than 25 billion equipment-embedded chips in the United States alone) makes some system breakdowns likely.

"Emergency services are crucial to the life and safety of Americans, and the Year 2000 problem poses a real and palpable threat to the continued operation of these services," said FCC Commissioner Michael K. Powell on April 29 before the Senate Special Committee on the Year 2000 Technology Problem.

The FCC has decided that the wireless communications sector, commercial and emergency, is at risk, "given the uncertainty of its efforts at this time."

## Y2K communications sector report

The FCC's efforts to identify risks posed to communications systems is documented in the *Y2K Communications Sector Report*, issued in conjunction with the Network Reliability and Interoperability Council (NRIC) on March 30. NRIC is a broad-based federal advisory group that was chartered to advise the commission on network reliability issues, including Y2K.

The FCC conducted a survey that targeted a random sample of 300 commercial wireless entities, including licensees

in the cellular service, personal communications services, SMRs and paging services. Thirty-one percent of all carriers responded to the survey. In 1997, however, there were about 108 million commercial wireless subscribers, so the responses received represented less than 40% of the entire wireless customer base.

The FCC said that it was encouraged by the progress being made by larger companies to prepare and was "cautiously optimistic" about the ability of the companies to withstand unforeseen problems with minimal disruptions to services.

The FCC expressed concern about the smaller companies, however. Many of the small- and medium-sized companies that have adopted a systematic approach to addressing Y2K have completion deadlines dangerously close to the dreaded date, which leaves scant time for delays from vendors or remediation of problems discovered during systems testing. Many small companies have not even adopted systematic approaches to addressing Y2K.

The report did not assess Y2K readiness in the private wireless community, which represents more than 16 million users, except in its discussion of emergency services (about 10% of private wireless). Because of concerns about the Y2K readiness of all wireless entities, the FCC is undertaking another survey to assess the status of non-commercial wireless licensees. Despite the FCC's lack of private wireless documentation, sources within that sector express confidence in general preparedness.

"Because private wireless systems promote productivity, few companies are anxious to provide detailed information on their Y2K compliance, which might be used against them by their competitors," said J. Sharpe Smith, communications and public affairs manager for the Industrial Telecommunications Association (ITA). "We have been

assured by the major radio system manufacturers that the lion's share of the land mobile communications equipment out there will not be affected when the calendar flips over to Jan. 1, 2000, or one of the other crucial dates."

"It is my sense that the major corporations in the United States have moved forward on this issue and are correcting any problems in their computer systems, including their private wireless systems," Smith said. "For example, Federal Express is already using its second generation of Y2K-compliant equipment in its mobile data terminals. Now *that's* proactive."

"It looks like users of older analog dispatch systems will be unaffected. This means that smaller companies, which don't have the staff to reprogram their radio systems, won't lose communications due to this computer bug. It is, perhaps, the mid-size companies with more complex networks that need to be the most careful," Smith said.

## Commercial services

The FCC's survey of wireless carriers revealed a preparedness gap between the large and small wireless companies. Only about half of the operators serving less than a half-million customers have implemented a remedial plan or process, while large operators have completed almost 60% of their fixes.

The survey did reveal that 54% of *total respondents* (representing about 23 million pops) have implemented a Y2K remediation plan or process. All of the responding carriers should have a remediation plan complete before December 1999. Because of the low response rate and the late completion date forecasted, however, the FCC said that

Chandler is senior associate editor. Her email address is [nikki\\_chandler@intertec.com](mailto:nikki_chandler@intertec.com).



## TX communications center plans for year 2000

Computerized public safety agencies are grappling with how best to prepare for the Year 2000. Even for innovative agencies, like the one in Richardson, TX, that adopted computer-assisted dispatching systems (CAD) in the late 1970s and have continued to update and improve their technology, the Y2K bug presents serious challenges that must be met over the next few months.

Richardson began a Y2K analysis of all electronic equipment, from computer hardware and software to photocopiers more than a year ago.

The city first formed a Y2K analysis team comprising staff members and consultants to identify the problem areas in each department, followed by a committee to present viable solutions and to develop contingency plans based on "what if" scenarios.

For Capt. Joe Hanna, manager of the Public Safety Communications Center for the city of Richardson, the analysis confirmed that the 250-employee department's communications system was *not*, as suspected, Y2K compliant. During the past several months, the department has identified several alternatives for solving the problem. These range from having the vendor upgrade the current CAD system to replacing it with a completely new, Windows NT-based system from another vendor to "applying a Band-Aid" to the existing system, which will provide a quick fix and buy them more time.

With countless man-hours and hundreds of thousands of dollars invested in hardware and software, replacing an

entire CAD system is no snap decision.

In the case of the Richardson center, people have labored long and hard to establish and continually improve the software systems used to run the public safety operations: CAD, mobile computing terminals, jail booking management, records management, warrants, citations and other modules.

As communications managers like Hanna, who is also president-elect for the Association of Public-Safety Communications Officials—International (APCO), ponder system overhauls for Y2K, they must consider issues such as data conversion: the data that pop up next year must be consistent with what's being used now. Staff must be trained, downtime must be managed.

The vendor Richardson bought its CAD system from in 1992 has itself been sold to a new owner, as have many legacy CAD vendors. Still, the Richardson department is assessing whether the new owner can help take the department's system where it needs to be, through the Y2K issues and in the longer term.

Like many CAD systems written in older computer languages, Richardson's will not operate in 2000 as is. Its vendor says the existing system can be upgraded into compliance. The system works well, Hanna said, and the department is satisfied with it. Because of the substantial money and time invested in the current system, Richardson opted for a "Band-Aid" interim solution that will allow its CAD system to continue running into 2000 and give the city time to

evaluate its long-term options.

"We're in line, waiting for our fix," Hanna said. "You weigh when you might move to the line that appears to be moving faster. But we don't know that we have another real choice but to apply the fixes we have. So we're taking the Band-Aid approach."

Richardson does have a choice about the extent of its fixes and what quantity of resources to devote to them. After clearing the Y2K hurdle, the city could then decide to acquire an entirely new CAD system, Hanna said.

It might. For the Richardson center, the Y2K issue has catalyzed a review of the entire system and an investigation into what additional capabilities the department will need in the future to keep pace with the growing city.

For now, the baseline demand is to ensure that Y2K issues do not compromise basic CAD capabilities. If the system shuts down entirely, it would leave Richardson's police, fire and EMS operations operating manually; not impossible, but certainly a major setback.

Richardson, a city of 85,000 residents and a major business center for telecommunications companies, began studying its Y2K factors in late 1997. The city is still slightly behind where it would like to be, though, Hanna said. Right now, he added, if he and his staff were to decide a major change is needed, it might be impossible to act because many CAD vendors are booked up and the governmental procurement process is protracted.

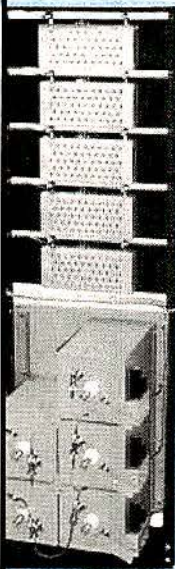
—Simon Aleman  
Global Dispatch  
Oklahoma City

greater effort should be devoted to contingency or backup plans.

### The backup backup plan

About 42% of the FCC's survey total respondents have begun contingency planning: 64% of large carriers and 40% of small carriers. The large carriers average less than 50% completion, however; and small carriers average 70% completion of probability of risk assessment for all items.

The impact of Y2K problems is hard to measure at this point, but the potential for disaster looms. Cellular, PCS and paging providers could lose revenue, customers and reputation for reliability. These risks incite some kind of preparatory action, with large carriers doing just that. However, as the survey showed, only about half of the other operators serving less than a half-million customer have implemented such a plan.



# EMR Corp.

R.F.  
SYSTEM AMPLIFICATION / COMBINING

## POWERPAK<sup>TM</sup>

**Integrated combiner/  
amplifier systems for  
trunking applications. Call  
us for your complete  
trunking system  
requirements.**

EMR Corp. 22402 N. 19th Avenue Phoenix, Arizona 85027 Tel: (602) 581-2875  
1-800-796-2875 Fax: (602) 582-9499 E-mail: info@emrcorp.com Web: emrcorp.com

Circle (43) on Fast Fact Card



## Emergency services

The FCC noted the importance of dispatch centers or Public Safety Answering Points (PSAPs) to emergency service call processing. Local communities own these systems and must take the necessary steps to prepare these systems for Y2K.

Costis Toregas, president of Public Technology, Washington, wrote in *American City & County* magazine in May 1999, that in fact, *multiple areas* of local government, from water services to public safety functions and emergency systems, needed to be Y2K compliant. "Y2K also affects functions as diverse as the operation of doors in jails and sophisticated medical devices in county hospitals," Toregas wrote.

The FCC stated that the challenge to emergency communications was that several systems must interoperate seamlessly to ensure timely response by emergency personnel.

"Virtually every link in the emergency chain involves complex interrelated processes, and everywhere there are time-date stamps," said Robert Miller, technical issues director of the National Emergency Number Association (NENA), at the "Year 2000: Maintaining Emergency Response Communications" forum.

A concern lies with the call processing at the PSAP. Such telecommunications equipment is not under the direct jurisdiction of the FCC nor within its area of expertise. The assessment of the readiness of the PSAPs is difficult because of the disaggregated nature of the control and ownership of this equipment, Powell said. NRIC estimates that there are 6,739 PSAPs in the territory of the eight largest telephone companies and that they have service contracts with 81% of those, or 5,456 PSAPs. Of those, 35% have been remediated for E9-1-1 call processing. These numbers do not account for small PSAPs, which the FCC doesn't know about.

## Dispatch remediation

The third element in emergency communication involves dispatching emergency response teams. Manufacturers report that analog and digital radio systems operating in unencrypted, conventional mode (non-trunked mode not involving computer switching) are not date-sensitive and therefore are not typically at direct risk for Y2K failure.

For radio systems using computerized trunking, encryption, gateway and other advanced computerized features that are at higher risk for Y2K failure, manufac-

turers report that they are engaged in active user notification and remediation assistance programs. The major manufacturers controlling 90% to 95% of the public safety equipment market have reported that all new equipment now being sold is Y2K ready, and upgrades or remediation packages for all legacy equipment are now or will shortly be available.

Computer-assisted dispatch (CAD) may be at greater risk for Y2K failure. Replacing CAD systems may also take more than one year, so non-compliant CAD systems might not be able to be replaced by 2000 (see sidebar on page 43).

## Accountability for failure

The risks stretch beyond equipment failure, however. Companies and governments could face lawsuits. The volume of legal claims from Y2K is projected to total as much as \$1 trillion. Citizens could claim damages for personal injury resulting when a city's E9-1-1 emergency dispatch system is slow or non-operational, delaying the arrival of an ambulance or police.

It is too late to start planning for Y2K. If a company, carrier or agency does not have a remediation plan in place, contingency planning is a must. ■



**MOTOROLA** TelePath is an authorized distributor for the . . .

## TS11 Portable

- Voice Prompt Programming
- 38 Built In PL Codes
- 12.5 / 25 KHz Operation
- X-Pand on 12.5 kHz Frequencies
- VHF or UHF
- Uses same accessories as SP10/TS10

**In Stock Now!**

Available for Immediate Delivery

## Dealers

The TS11 Portable is a Full Margin Product



**TelePath**

49111 Milmont Drive  
Fremont, CA 94538-7347

**1-800-292-1700**

(510) 656-5600

Fax (510) 656-2114

Visit us on the Web at: [www.telepathcorp.com](http://www.telepathcorp.com)

Circle (44) on Fast Fact Card

## DESKTOP POWER SUPPLY with BATTERY BACK-UP



Combine one of our low profile desk top LP Series power supplies, a suitable battery, and one of our LPBB solid state battery backup modules to provide a compact, easy to install, low cost UPS.

- 4 LP models available, peak output rated from 10 to 25 "Amps".
- Compact size, 1.75"H x 7"W x 7.62"D.
- LPBB provides seamless solid state transfer to battery power when AC mains go down. Float charges the battery when power is restored.

Contact your communications distributor, or call or fax us Toll Free

**Phone 1-800-467-6741 Fax 1-800-825-1403**

**DuraComm®**  
CORPORATION

203 W. 23rd Ave.  
North Kansas City, MO.  
64116

On the Web at [www.duracomm.com](http://www.duracomm.com)  
Email: [duracomm@duracomm.com](mailto:duracomm@duracomm.com)

Circle (45) on Fast Fact Card



## Backup power service

By Harold Kinley, C.E.T.

The backbone of the South Carolina Forestry Commission's radio communications system is a VHF high-band repeater network with associated control stations at strategic points. Some of the repeaters are located at sites that have backup generators on standby. If the power fails, the generator will start and, once stabilized, will supply power for continued operation during the power outage. The other sites have no available backup generator. A question arose as to how we could obtain an alternative (meaning less expensive) source of backup power for these other sites.

Our repeaters, base stations and control stations operate from a 12V power supply. In our particular forestry region, our repeaters, control stations and base stations are scattered over a 19-county region. We also have personnel with pickup trucks, transport trucks and crawler tractors spread out over the same geographical region. At least one employee is stationed near to almost every base station, repeater or control station. So, the idea of using a vehicle's 12V battery to supply temporary backup power in an emergency was a cheap alternative to installing permanent power generators at these remote locations.

Sure, there would be some downtime

associated with a power outage, but the tradeoff of some downtime against the cost of permanent backup generators was considered acceptable. All we needed to do was come up with an arrangement that would allow employees to temporarily hook up the vehicle battery through jumper cables to supply battery power to the repeaters or base stations, as needed. The idea was to make it simple and goof-proof (or should I say, goof-resistant) so that any chance of a calamity was minimized.

The base stations and control stations that we use would be no problem because they have a direct 12V external power supply. The repeater has its own internal power supply, but a study of the power supply schematic indicated that it would be possible to integrate the external 12V supply with this internal supply so that no conflict would occur.

Figure 1 below is a diagram of the basic hookup that is used to facilitate using a vehicle battery as the temporary emergency power source. The plus (+) and minus (-) connecting points shown to the right in the diagram are connected to copper pipes that are inserted through

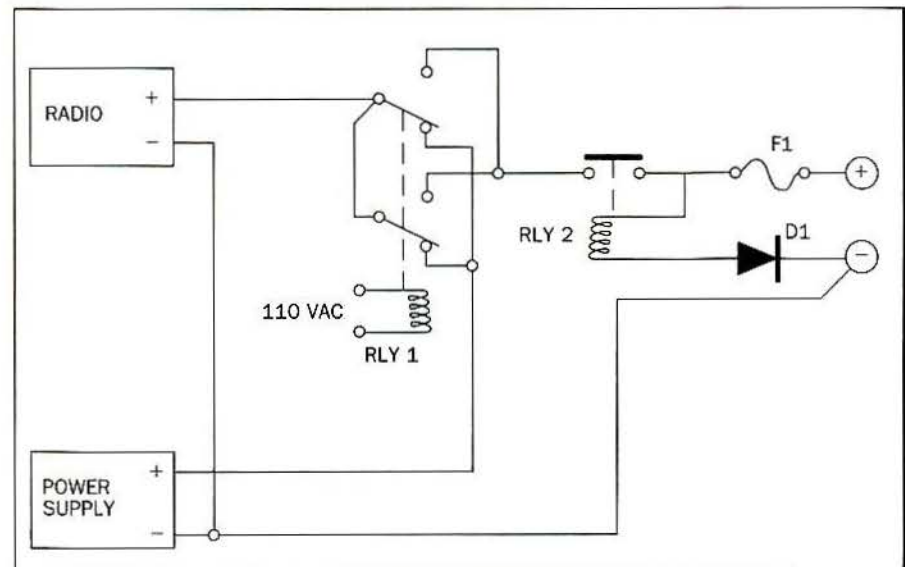
the concrete walls of the communication shelters. The pipes are flattened on one end, and a hole is drilled through the flattened end to accommodate a 0.25" stainless steel bolt to which the electrical connections are made. On the outside of the building, a clamp is attached to the copper pipe at the entrance to the building to hold the pipe snugly against the building.

It is important to use heavy-duty relays with contacts sufficient to carry the current load. In Figure 1, two sets of contacts are connected in parallel. For an extra measure of safety, two relays can be used with the same points connected in parallel to handle heavier

**All we needed to do was come up with an arrangement that would allow employees to temporarily hook up the vehicle battery through jumper cables to supply battery power to the repeaters or base stations.**

load currents. Photo 1 on page 45 shows a board with two relays connected in parallel for extra current-handling capability. Notice in Figure 1 that only the positive leg is controlled by the relay. Relays could be used for both legs, but connecting only the positive leg through the relays allows us to lower the voltage drop across the contacts. This also helps prolong relay contact life because each set of contacts is only required to carry a small part of the total load current.

Notice in Figure 1 that relay RLY2 is connected between the positive connecting post and the control relay (RLY1). This relay (RLY2) is a heavy-duty solenoid-type relay that is used in automotive applications such as the "starter solenoid." The positive and negative connecting posts are accessible through the outside of the wall, so that an employee can attach jumper cables from a vehicle to the connecting posts without entering the building. The diode (D1) is inserted in series with the relay coil, so if the jumper cables are



**Figure 1:** This is the simple schematic of the wiring and control relays used to facilitate connection of emergency power from a vehicle's battery to power the radio during a power outage.

Kinley, a certified electronics technician, is regional communications manager, South Carolina Forestry Commission, Spartanburg, SC. He is the author of *Standard Radio Communications Manual: With Instrumentation and Testing Techniques*, which is available for direct purchase. Write to 204 Tanglewyld Drive, Spartanburg, SC 29301. Kinley's email address is [hkinley@home.com](mailto:hkinley@home.com).



**CELLULAR, PCS & WIRELESS LOCAL LOOP  
MICRO FILTER PROTECTION**

THE  
INDUSTRY'S  
FINEST  
LIGHTNING  
PROTECTION  
PRODUCTS



**SX SERIES**

- Low VSWR and Insertion Loss
- dc Blocked
- Multi-Strike Capability
- Cellular, PCS & Wireless Local Loop Frequency Ranges Available
- Industry's Best RF Performance
- Maintenance Free
- Fully Weatherized Housing



[Actual Size]

**PolyPhaser®**

A SMITHS INDUSTRIES COMPANY

P.O. Box 9000, Minden • NV 89423-9000 USA

Tel (800) 325-7170 (775) 782-2511

Fax (775) 782-4466 • www.polyphaser.com

ISO 9001 CERTIFIED

connected with reversed polarity, the relay will not be energized and reversed polarity will not be applied to the radio. The relay will energize only when the correct polarity is applied to the connecting posts.

As long as the commercial power is available, the control relay (RLY1) is energized from the 110V ac supply. If a power outage occurs, the control relay is de-energized, and the relay contacts move to the normally closed position. This connects the radio positive lead to the emergency power connecting posts. The radio is dead until personnel arrive and connect a jumper cable from a vehicle to the connecting posts. When commercial power is restored, the control relay is again energized, and power is obtained from the normal power supply.

Heavy-gauge wire should be used for longer runs. The relay wiring can be done with smaller wire for jumpers that are only a few inches long. The voltage at the radio should be checked in both the receive and transmit modes. If the voltage drop in the transmit mode is significant, find out where the voltage drop is occurring. Check across the relay contacts, across the wire between the relay(s) and the radio, and between the relay(s) and the connecting posts on the wall of the shelter.

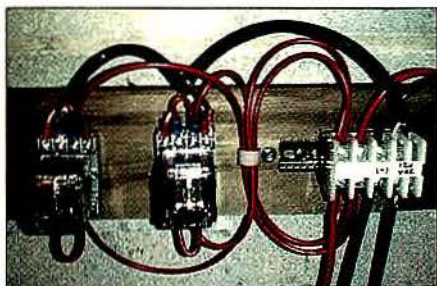
This backup power "system" is about as simple and inexpensive as it gets. It won't suit the needs of all agencies or operations, but there are many situations where such an application is a viable option and can save a fair amount of money. Employees must be trained to hook up the vehicle jumper cables properly when needed. Alternatively, a battery (deep cycle, marine lead-acid type) can be used along with a "float" charger. The connections to the battery can be made from the "through-wall" posts without the need for the switching relay circuit. The solenoid relay should still be used to prevent improper polarity. An isolation diode should be connected between the positive lead of the float charger and the positive battery post. A number of variations are possible using this same basic principle.

Until next time—stay tuned! ■



**Photo 1:** A fuse is connected between the "through-wall" post and the solenoid relay. Of course, the fuse needs to be adequate to handle the load current.

**Photo 2:** This 12V solenoid is used to connect the external power source to the radio for backup power. It is energized when the correct polarity is applied to the "through-wall" posts. The diode prevents incorrect polarity from energizing the solenoid relay.



**Photo 3:** This control relay panel for the MSR2000 repeater is mounted on a board and attached to the wall near the repeater. Two relays are used in the positive leg to prevent too much voltage drop across the relay contacts.

**Photo 4:** The "through-wall" negative, or ground, post. The end of the copper pipe is flattened and the negative power lead is attached with a 0.25" stainless steel bolt.



Circle (46) on Fast Fact Card



## ComSpace readies DCMA for 2000

ComSpace, founded by former Uniden America executives David George and Steve Fulford, has spent several years in developing a spectrum-efficient technology with initial applications in business and industrial private two-way radio. The Irving, TX-based company demonstrated its progress toward delivery of microchips, software, mobiles and base stations at IWCE in April.

As microchips and software become available, any radio manufacturer will be able to use them to make mobile two-way radio units with "digital channel multicarrier architecture" (DCMA) capability. DCMA places the equivalent of eight voice channels within the space of one 25kHz FM channel at 450MHz and 800MHz, four channels within 12.5kHz at 900MHz and two channels within 5kHz at 220MHz.

"We have received full samples of the application-specific integrated circuit (ASIC) from VLSI," said George, the company's executive vice president. "It's

the whole back end of a digital radio, including the analog and digital con-

verters, vocoder, keyboard decoder, LCD driver and IRD port and SIMM card reader, plus the DCMA system.

That makes a very nice implementation for a manufacturer. They have only to put this chip in a digital radio, and they have a fully com-

pliant DCMA product. That means brand 'X' can talk to brand 'Y' without standards documents, auditing or testing."

Last summer, ComSpace altered its technology direction, discarding a previous analog air interface in favor of a digital interface.

"With digital, we were able to improve bandwidth efficiency, and we now have eight times capacity improvement," George said.

George described the digital DCMA design as "a lot more work and a good decision" despite its higher complexity compared to analog DCMA. In an analog system, any problem with a synthesizer comes out as an audio signal, which can result in odd squeaks and buzzes, he said.

"In a digital radio, it's just ones and zeros. Noise might come out as a fraction. Mechanisms do error correction and detection. You can have a lot more of those issues than in analog without degrading the sound quality, and as a fringe benefit, a digital radio is good for carrying data," he said.

DCMA supports trunking protocols through its "service option negotiation" or SON.

"SON is like the modem on your PC," George explained. "It takes data, whether Microsoft Word or PowerPoint or JPEG, and converts it into a signal that can pass over telephone wires and reconverts at other end. That's roughly what SON does. If the people who use DCMA want to use Johnson LTR trunking, SON converts the trunking data stream to high-speed digital mixed with voice. At the other end, it filters the LTR out and reconverts it to 300-baud FSK."



ComSpace demonstrated DCMA in its booth at the IWCE trade show in April, where it also demonstrated the technology in use in a van during test-drives.

### Competitors in spectrum efficiency

Voice paths within an equivalent 25kHz FM channel:

Manufacturer	Technology
Motorola IDEN (TDMA)*	6:1
SEA (ACSSB)**	5:1
Intek Global (linear modulation)	6:1
ComSpace (DCMA)	8:1

\* Motorola offers a 3:1 option to improve voice quality.

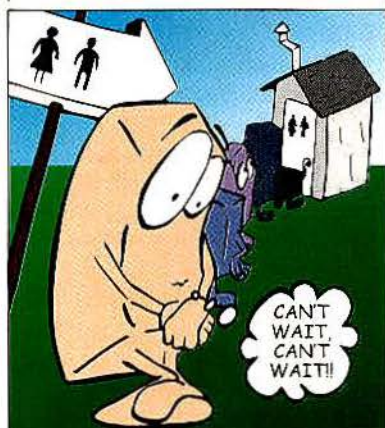
\*\* SEA can double its capacity to 10:1 with ACSSB/DCMA.

Note that these figures apply to voice-channel capacity and not necessarily voice quality. Data throughput may favor one technology over another despite the voice channel capacity comparisons.

# REDUCE WAITING TIME WITH FASTER BATTERY CHARGING

## their way

### Single Power Supply



## our way

### Multiple Power Supplies



Relieve your batteries with the industry's only truly simultaneous recharging system



Battery Rejuvenation  
For A Cleaner World

BatteryPro  
Systems Inc

Phone 800.661.9401  
Fax 403.933.3233  
Email sales@batterypro.com  
Web www.batterypro.com

Circle (47) on Fast Fact Card



One part of ComSpace's strategy that hasn't changed is its plan to build base stations.

"We've always intended to make the base stations ourselves," George said. "Then we also decided to build our own mobile radio because most of the manufacturers are slow, and we need some kind of a product to develop the marketplace and to prove the technology. We're developing our own radio for that. We will eventually sell the design to someone. We don't intend to be a radio manufacturer. We want to seed the market."

"We want to build base stations, though, because they need to be built robustly. A base station needs to be reliable to support hundreds of customers," he said.

Another motivation is the profit margin on base stations, which is higher than that for mobiles.

"We've already spent \$13 million to develop DCMA. We took all the risk and spent the money, and we need to recover the investment," George explained. "The base stations sell for a higher price, so they produce more revenue."

ComSpace's goal is to maintain the dynamics that the FM market enjoyed, meaning a lot of suppliers who are motivated to make innovative products at good prices.

"The FM market is not as healthy as it used to be because users are out of capacity," he said. "With DCMA, we'd like the manufacturers to 'duke it out' for the best units, all with our chips in them. DCMA works at multiple band-

widths, and it isn't frequency-sensitive. We can even double the capacity of a 220MHz channel."

DCMA doubles 220MHz channel capacity with time-domain duplexing. The method allows two voice paths within the same bandwidth, and it allows a single duplex voice path of the type used for telephone-type interconnect. In other words, each party to a conversation can be heard by the other without using a push-to-talk switch common to "half-duplex" mobile radio telephone interconnect. The use of time-domain duplexing avoids the need for a mobile cavity-type duplexer, which at 220MHz would be large.

ComSpace had licensed several manufacturers for its previous analog DCMA, and it has licensed a few for the new digital DCMA. Among the licensees are Datamarine International with its SEA Division, Transcript International and its EFJohnson Division, the Kenwood Systems subsidiary of Kenwood Communications, Zetron, Trident Micro Systems, SmartLink Development and Lenbrook. Lenbrook is one of ComSpace's initial investors.

Additional information is available on two Web sites: [www.comspacecorp.com](http://www.comspacecorp.com) and [www.dcmaradios.com](http://www.dcmaradios.com). *DB*

#### ComSpace Timetable

Microchips	5 weeks ARO
Software	October
Mobiles	1Q 2000
Base stations	1Q 2000

## ACT changes name to Enrev, licenses software

Advanced Charger Technology (ACT), Atlanta, has changed its corporate name to Enrev Corporation. The company will use the name ACT, but only for the unit that will continue its business in battery chargers. The company's main growth engine will be the licensing of the battery operating system. The company, still privately held, has been raising money from venture capitalists and has raised \$5.5 million. Enrev employs 65 people.

The software, Enrev OS, allows batteries to charge five times faster, deliver consistent, dependable power between charge and sustain four times longer than currently available technologies.

"Research has shown that battery limitations are a significant hindrance to mobile device performance and long-term reliability," said Karen Robinson, president of Enrev. "If battery performance can be substantially improved,

so can the usefulness and productivity of the devices they power. That's what Enrev Corporation is all about."

Throughout the charging process, the Enrev operating system adapts responsively to the battery's electrochemical state via a unique algorithm that provides real-time feedback, maintaining the battery at the optimum charge level. Scalable and effective with all major battery chemistries in use today, Enrev technology can be designed into the electronics of devices such as cellphones, personal digital assistants and laptop computers as well as forklifts and electric vehicles. The system blends the disciplines of electrochemistry and electrical engineering to form a stimulus response model that interactively and dynamically charges the battery. Enrev technology works with all major battery chemistries including Li-ion, NiMH, NiCd, lead acid and Li-polymer. *MRT*

## FCC Notes

### LMDS auction raises \$45 million

In May, the FCC completed a Local Multipoint Distribution Services (LMDS) auction that raised a total net revenue of \$45,064,450. The auctioned licenses can be used by companies to provide a variety of wireless services for consumers including: one- and two-way broadband services, such as video programming distribution; video teleconferencing; wireless local loop telephony and high-speed Internet access.

The auction began on April 27, 1999, and closed after 43 rounds. A total of 161 licenses, 100% of the licenses available in the auction, were sold to 40 bidders. The licenses will be awarded in various geographic areas throughout the continental United States and Puerto Rico.

### FCC dismisses petition against Nextel License Holdings 4

On June 22, 1998, Dennis Brown and Robert Schwaninger Jr. filed a Petition to Dismiss or Deny against Nextel License Holdings 4 on behalf of clients who operate 800MHz SMR systems in the Maricopa County, AZ, area. In the petition, dismissed by the FCC on April 30, 1999, Brown contended that certain 800MHz SMR applications filed by Nextel were defective and did not comply with the FCC's rules. He also alleged that the applications contained misrepresentations of material facts that require the FCC to ascertain whether Nextel had the character qualifications to be an FCC licensee. He contended that the applications did not comply with Section 90.693 because Nextel had no incumbent stations whose 22dBu field strength contour could encompass Nextel's proposed sites. The FCC requested that Nextel provide additional information regarding the application, and Nextel acknowledged that it had incorrectly calculated its existing composite 22dBu contour with respect to certain sites specified on the applications. Based on this, Nextel surrendered the licenses for all 800MHz stations that were previously granted in Maricopa County and also withdrew its one remaining pending application in Maricopa County. The FCC also rejected the claim of whether Nextel had made intentional misrepresentations.



## Batteries

### Batteries support wearable power source

**B**attery Engineering's rechargeable lithium battery systems are for wearable power sources. The lithium power systems offer the high power needed for advanced industrial and military applications, but are less than half the weight of the NiMH systems. The power sources come in standard and customized sizes. The standard offering for wearable systems is a flat, lithium-ion polymer cell measuring 4" x 6". It will fit into vest pockets and will allow various voltage taps to be picked as needed. The system offers 14Ah of rechargeable capacity at 12V. In custom configurations, battery size and voltage can be designed to customer specifications. The cells can be recharged as much as 500 times and discharged as high as the 2C rate. A single charge lasts about eight hours, making it suitable to last a complete shift in an industrial application.

Circle (351) on Fast Fact Card



### Batteries work for Ericsson radios



The R1202 (1,200mAh) and R1203 (1,700-mAh) replacement batteries from Alexander Technologies are for Ericsson Prism radios. The batteries have an ultrasonically sealed high-impact housing. The batteries are constructed new to meet or exceed OEM specifications. The company does not retrofit (rebuild) used batteries. The shelf life is five years when stored at 77°F. Each cell is safety-vented.

Circle (353) on Fast Fact Card

### Primary batteries feature high voltage



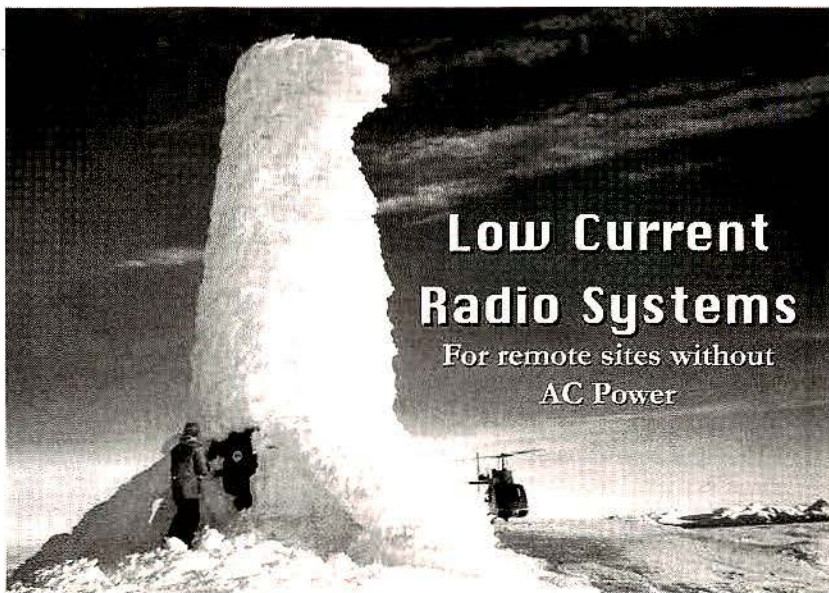
Tadiran's Pulses Plus 3.6V cylindrical primary batteries are lithium thionyl chloride cells that deliver the higher voltage, higher capacity and lower self-discharge required by high-current pulse applications. The batteries have a hermetically sealed hybrid layer capacitor (HLC) and bobbin-type construction. Features include a capacity of 19Ah for the D size cell, and a self discharge of less than 2% per year.

Circle (354) on Fast Fact Card

### Battery provides reliable backup

**Hawker Energy Products** has expanded the Hawker XT series of valve-regulated, lead-acid batteries to include a new footprint, the Hawker XT 35. The batteries provide reliable backup in distributed power and wireless telecommunications where abusive environments are increasingly commonplace. The battery is a replacement for distributed power cabinets, and it offers 35Ah in a 25Ah shelf. The battery is a suitable replacement for remote telecommunications cabinets and SLC replacements. The battery is designed in an industry-standard JIS footprint, constructed in red, 94V-0 flame-retardant plastic.

Circle (352) on Fast Fact Card



### Low Current Radio Systems

For remote sites without AC Power

#### Synthesized and Crystal

- Base Stations and Repeaters
- 29 - 960 MHz
- Compact Crossband Systems
- High Reliability
- -40°C to +60°C (no degradation)
- Fast response, no sleep modes

**DE DANIELS**  
ELECTRONICS LTD.

Call: 800-664-4066 or 250-382-8268  
Email: sales@danelec.com  
Web: www.danelec.com

Circle (48) on Fast Fact Card



## D.T.M.F DECODER

For interconnect and remote control applications

The Model NC401 is a micro-miniature DTMF

decoder, designed for selective control of local or remote applications.

Measuring .80"W x 1.37"L x .23"H, the NC401 combines three distinct, multi-addressing decoders offering multiple user-configurable functions. All programmed features are stored in non-volatile E2Prom memory and are easily programmed by means of a conventional DTMF encoder or the Model NC500 Universal/P.C. programmer. This highly engineered decoder is ideal for portable radio applications having limited space for accessories. The NC401 comes complete with micro-miniature 14 pin header and 12" color coded cable assembly.

Model  
NC401



\$59.95

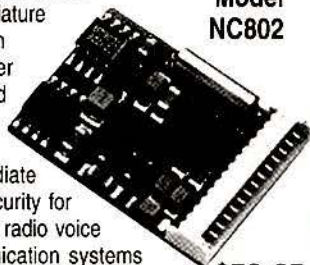
Nor-fax Doc. #5545

## VOICE SECURITY ENCRYPTION

The Model NC802 is a miniature inversion scrambler designed to provide

intermediate level security for two-way radio voice communication systems and is a perfect, cost-effective solution to entry-level voice scrambling as a defense against unauthorized or casual listeners. The NC802 provides eight user selectable carrier codes commonly used by other manufacturers and interfaces easily to most radios with near transparency to the user

Model  
NC802



\$59.95

Nor-fax Doc. #5759

For Detailed Specifications or Product Catalog call our 24-Hour NorFax retrieval system at 530-477-8403, Email: info@norcommcorp.com or our website: www.norcommcorp.com



800-874-8663

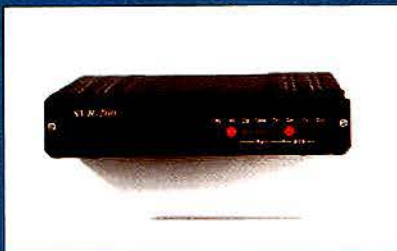
15385 Carrie Dr., Grass Valley, CA 95949 USA

Circle (49) on Fast Fact Card

## READERS' CHOICE

Of the new products in the November 1998 issue, this one generated the biggest reader response. For more information on this product, circle the corresponding Fast Fact Card number on the card found in the back of this issue, and mail the card to us.

### Vehicular repeater extends hand-held range



The SVR-200MA vehicular repeater from **Pyramid Communications** is available for UHF, VHF and 800MHz transmitters. The repeater extends the range of the hand-held radios by interfacing between a high-power mobile radio and a low-power hand-held, and is Motorola PAC/RT,

LTR, EDACS and Motorola trunking compatible. The repeater features completely automatic operation and the ability to create a priority multi-unit hierarchy for as many as 256 vehicles. In addition, the unit offers "first man out" with priority sampling. This compact unit (5.275" x 6" x 1.12") offers benefits to public safety, paramedics, utilities and fleets by providing wide-area coverage without expensive satellite receivers, maintaining communications even inside buildings and eliminating the need for pagers and cell phones.

Circle (500) on Fast Fact Card

### Antennas provide wideband coverage

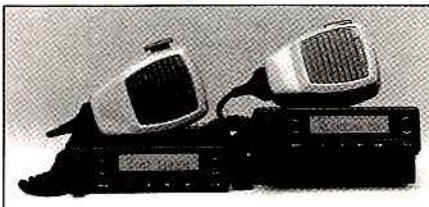
The **Maxrad** Low-profile Vertical (MLPV) antenna series consists of two models capable of covering frequencies from 806MHz to 960MHz and 1,700MHz to 2,500MHz with superior pattern coverage. The attractive, compact design makes the antennas suitable for mobile or base station applications requiring minimum visibility. A 3/4" hole mount mechanism helps installation into

an existing mount and/or replacement of existing antennas. They provide superior performance to a quarterwave over a ground plane.



Circle (401) on Fast Fact Card

### Mobiles operate in trunking or conventional



The TK-780/880 VHF and UHF mobiles from **Kenwood Communications** are part of the 80 series family of radios that are designed to operate on multiple systems: conventional, trunking, wide or narrow bandwidth. The radios feature Fleetsync, which provides built-in alphanumeric two-way paging. The mobiles operate in either LTR trunking format or conventional format. In LTR trunking mode, the radio has a capacity of 32 systems with multiple talk groups.

In conventional mode, the radio is capable of 250 channels. The Fleetsync feature means pre-stored status messages and customer alphanumeric text messages can be sent and received. Messages can be stored in memory for later review and each unit's pre-assigned ESM is tagged to messages for origin identification. The mobiles have a data connection port for modems or external mobile data terminals, an option available with the addition of the Kenwood KCT-19 or KGP-1A and KCT-20 options (for AVL capabilities). The units are built to meet or exceed U.S. military standards 810 C, D and E. The die-cast chassis and compact design make the mobiles easy to install in any vehicle.

Circle (402) on Fast fact Card



## Trunking antenna performs at 3dBd gain



The ASP-7920 800MHz rooftop trunking antenna from **Antenna Specialists** is suitable for trucks and cargo vans. The antenna produces a full 3dB (5dBi) omnidirectional gain from its  $\frac{5}{8}$  wavelength upper and  $\frac{1}{4}$  wavelength lower section whip, and covers the 806MHz-869MHz frequency range without tuning. With one-piece stainless steel whip construction including phasing coil, this antenna has a VSWR of better than 2:1, a 100W maximum power rating and ships with a  $\frac{3}{4}$ " universal Motorola NMO-style mount for convenient installation. Available in three model configurations, the ASP-7920 includes a 17' Pro-flex cable. The ASP-7921 has a 14' RF-58/U.

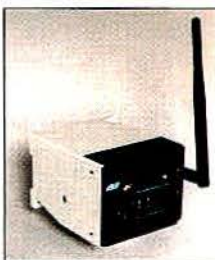
Circle (403) on Fast Fact Card

## Spread-spectrum modem links various devices

The **Aerotron-Repcos Systems** Bluestreak is a high-speed digital communications modem capable of linking various electronic devices. Because wireless RF spread-spectrum technology, no FCC license is needed. Plug in the unit and immediately establish a data link. The unit can be configured in point-to-point, point-to-multipoint and broadcast group operation. In broadcast mode, all units within the group receive messages from one unit within the group. Repeaters can be configured for broadcast groups as well. With the fast setup

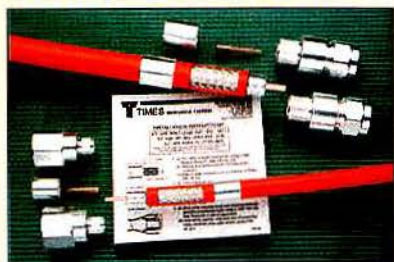
feature, just press a button on the modem to initiate handshake operation with other modems. Data transfer between modems including compatible communication parameters and address information. After fast setup, the modems can be placed in service and do not require any additional setup operation.

Circle (405) on Fast Fact Card



## Looking for a reliable mobile computing network?

### Connectors work with plenum cables



**Times Microwave Systems'** Ez connectors are for the plenum-rated LMR-400-LLPL and LMR-600-LLPL cables. These connectors can be installed on the cable with no soldering of the center pins and with a crimp connection to the outer conductor. Cable prep tools are available to trim the cable to the proper dimensions for connector attachment. The entire process of cable trimming and connector attachment can be accomplished in minutes, resulting in savings in installation costs. Connectors with solder-on center pins are also available. The cables combine low loss and flexibility with a plenum rating. This allows for their installation inside buildings anywhere, including air-handling spaces. Their flexibility allows easy routing in tight spaces making them suitable as antenna feeders for many applications.

Circle (404) on Fast Fact Card

Let our experience be your guide.

For more than a decade, DATARADIO has been an industry leader in providing mobile computing networks around the globe.

DATARADIO goes the distance to provide customers with quality coverage, reliability, and cost-effective performance.

As you chart your course for a wireless solution, let us give you some direction. For more information about our mobile computing network solutions, call 770-392-0002 or visit our web site at [www.dataradio.com](http://www.dataradio.com).

**DATARADIO®**

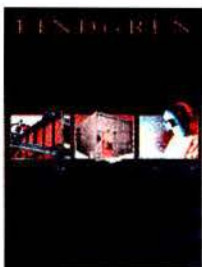
Inside U.S.A.  
DATARADIO Corporation  
6160 Peachtree Dunwoody Road, Suite C-200  
Atlanta, GA 30328  
Phone: (770) 392-0002 Fax: (770) 392-9199

Outside U.S.A.  
DATARADIO Incorporated  
5500 Royalmount Avenue, Suite 200  
Town of Mount Royal, Quebec, Canada H4P 1H7  
Phone: (514) 737-0020 Fax: (514) 737-7883

Circle (50) on Fast Fact Card



## Brochure covers welded shielding system



**Lindgren RF Enclosures'** welded shielding system details the room concept that provides high-level EMI/RFI shielding and offers long-term,

maintenance-free RF performance and structural integrity, compared to mechanically clamped shielded enclosure designs. It supports requirements of 30Hz to 94GHz and exceeds the RF performance requirements of government specifications MIL-STD 284, NSA 65-6/94-106 and CID 09.12.

Circle (451) on Fast Fact Card

## Service supplement features tool kits

**Contact East's Spring Service Supplement** includes products for testing, repairing and maintaining electrical and electronic equipment. Products highlighted in this issue include power supplies, cable testers, tool cases, shipping containers, telecom test sets, soldering supplies and ESD protection equipment. It also includes a 16-page insert of standard, custom and modifiable tool kits.

Circle (452) on Fast Fact Card

## Antenna and Cable

### ANALYZERS

**The AEA Division of Tempo** specializes in hand-held test instruments for the wireless communications industry.

#### SWR Analyzers

Our commercial line of SWR instruments include: **30-150 MHz, 140-525 MHz and 700-1000 MHz.** These quality products give a graphical presentation of the SWR and Return Loss curves for an antenna or tuned circuit under test. Each product includes Windows™ 95/98 applications for saving and printing curves. Each product is priced in the US at **\$599.95, \$659.95, and \$759.95** respectively, plus \$7.50 shipping and handling.

#### Complex Impedance Analyzer

For the HF range, we have complex impedance analyzers in the same package as the SWR analyzer products. These products offer virtually all the features of the SWR analyzer products plus many additional features such as **graphical presentation of Impedance, Resistance, Reactance and phase angle curves.** The distance to the nearest short or open in a coax cable can easily be determined. You can tune antennas and most tuned circuits within the frequency range. Call for details.

#### Cable Fault Locators

AEA offers a complete line of products to give the user the ability to **easily find faults in cables.** Our tone locator systems start as low as \$85.00 and our precision step TDR (Time Domain Reflectometer) product beats any competition at only \$3535.



**The CableMate™** at \$499.95 is the lowest priced graphical TDR available, anywhere. It will **display simultaneous faults** out to 2000 ft. with the best **RF noise filter** known in a TDR. An RS-232 port is standard. The user can store up to 15 plots in the internal memory. Outputs are provided for **coax or twisted pair** cables. An external oscilloscope can be used for enhanced sensitivity.

The new **TR-3120 Step TDR** gives the user **resolution to better than one inch,** with the ability to determine the **impedance of any discontinuity** including connectors and splices. Faults can be spotted in the first inch of cable out to about 4800 ft.

See complete information on these and other products on our website.

[www.aea-wireless.com](http://www.aea-wireless.com)



A Division of  
Tempo Research Corporation

Phone: (800) 258-7805 or (760) 598-8900  
Fax: (760) 598-5634  
e-mail: [aea@aea-wireless.com](mailto:aea@aea-wireless.com)  
1390 Aspen Way • Vista, CA 92083

\*Prices and specifications subject to change

Circle (51) on Fast Fact Card

## Catalog highlights IDEN accessories

**Motorola Accessories and Aftermarket** division has released a 44-page, color brochure describing the collection of accessories available to support Motorola's IDEN line of PCS handsets used by Nextel and Southern LINC, as well as dealer-based subscriber systems and Clearnet in Canada. Audio accessories for the various IDEN models are complemented by descriptions of carrying cases, car installation kits and chargers. A full line of Motorola original NiCd, NiMH and lithium ion replacement batteries are also offered.

Circle (453) on Fast Fact Card

## Book details marketing considerations

**The Complete Wireless Communications Professional: A Guide for Engineers and Managers** from **Artech House** details engineering principles and examines the financial and marketing considerations that contribute to making any communications product viable. The book provides a relevant history of mobile radio, the technical basics of cellular and private mobile radio technologies and the descriptions of the design and operation of mobile networks.

Circle (454) on Fast Fact Card

## Media correction

The "Media" item, "Color Brochure Describes Terminal" (*MRT*, June 1999), features an incorrect company name for the publisher of the Explorer II brochure. The correct company is Globecom Systems, Hauppauge, NY.

[www.globecomsystems.com](http://www.globecomsystems.com).





Campbell



Perelman



Hoff



Snader

**Guy Campbell** departs Ericsson, Lynchburg, VA, as vice president, wireless business systems, to join Andrew, Orland Park, IL, as group president, wireless products and distributed communications systems.

**Robert Perelman** leaves Eupen Cable USA, St. Petersburg, FL, as vice president, sales, to rejoin Times Microwave, Wallingford, CT, as vice president, commercial sales and marketing.

Changes at Tru-Connector, Peabody, MA:

**Robert F. Hoff**, vice president sales and engineering, retires after 40 years at Tru-Connector. **Douglas E. Snader**, sales manager, succeeds Hoff as vice president of sales and engineering.

**Francois Robitaille**, director of international marketing and sales at Davicom Technologies, Trois-Rivieres-Ouest, Quebec, Canada, advances to vice president, marketing and sales.

Personal Communications Industry Association (PCIA), Alexandria, VA, award recipients:

**Rep. Billy Tauzin** (R-LA), chairman of the House Telecommunications Subcommittee, receives the Lifetime Achievement Award. **Thomas Tycz**, chief of the FCC International Bureau's Satellite and Radiocommunications Division, receives the Eugene C. Bowler Award.

**Ian Shergold**, managing director of Huber+Suhner AB in Sweden, moves to senior vice president of Huber+Suhner, Essex Jct, VT. Shergold succeeds **Les Judd** who transfers to start Huber+Suhner Integrations in Phoenix.

Changes at Trilogy Communications, Pearl, MS:

**Bruce Carlson**, director of the network product division and engineering, advances to vice president of the division. **Gary Cohen** leaves BNOX as director of finance and administration to join Trilogy as vice president of finance. **James J. Bottomley** departs Wavetek Wandel & Golterman, Research Triangle, PA, as director of sales to join Trilogy as national sales manager of wireless network products. **Stanley A. Nevers** leaves Motorola as a national account sales manager based in Atlanta to join Trilogy as eastern regional sales manager of network products. **Jim Oldham** exits Sprint North Supply, New Century, KS, as executive account manager to join Trilogy as vice president of domestic sales for its CATV products division.

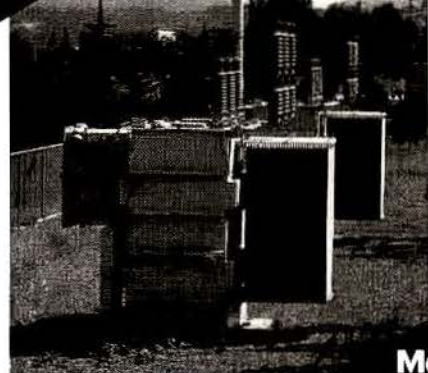
**Dale Sydnor**, Noise Com's chairman, moves up to vice president of Eatontown, NJ-based Telecom Analysis Systems' new product development and support facility in Mahwah, NJ. He joins TAS as a result of the acquisition of Noise Com by TAS.

# Wireless Substation Monitoring Combines SCADA & Telemetry to Control Remote Sites



Low-cost Wireless RTUs

Use Existing Radios & Sensors



Modernize your System

- ◆ Modbus compatible
- ◆ Replace costly leased lines
- ◆ Alarm response with voice & data

Call: 425.820.6363  
FAX: 425.820.7031

**ZETRON®**

Email: [zetron@zetron.com](mailto:zetron@zetron.com)  
Web: [www.zetron.com](http://www.zetron.com)



# MRT



Dawn Rhoden  
Classified Advertising  
Manager

Reserve your spot in the next issue!

Phone: 913-967-1861

**800-347-9375**

Fax: 913-967-1735

Mail: 9800 Metcalf Ave.,  
Overland Park, KS 66212

## Category Index

Accessories .....	54
Business Opportunity .....	66
Computer Software .....	65
Employment .....	55
Equipment For Sale .....	56
Paging .....	67
Professional Consulting Services .....	54
Professional Services .....	54
Rentals .....	67
Repair Services .....	67
Services .....	66
Tower Services .....	66
Tower Space .....	66

## professional services

### FREDERICK G. GRIFFIN, P.C.



3229 Waterlick Road  
Lynchburg, VA 24502  
(804) 237-2044

NATIONWIDE COMMUNICATIONS CONSULTING  
Mobile Radio, Microwave, E9-1-1,  
CAD, Paging, LAN,  
Dispatch Communications Centers  
Multi Site Propagation Analysis

### MCCON

Mobile Communications Consulting  
S.R. McConoughey, P.E.  
Principal

13017 Chestnut Oak Drive  
Gaithersburg, MD 20878 (301) 926-2837



OMNICON, Inc.  
COMMUNICATIONS ENGINEERING

GENE A. BUZZI  
PRESIDENT

930 THOMASVILLE ROAD, SUITE 200  
TALLAHASSEE, FLORIDA 32303  
PHONE: (850) 224-4451 • FAX: (850) 224-3059  
E-mail: omnicon@polaris.net

### THE PORTABLE DEPOT, Inc.



- FACTORY TRAINED TECHNICIANS •
- SURFACE MOUNT TECHNOLOGY •
- FACTORY APPROVED NATIONWIDE •
- EDACS & AEGIS •
- VOICE GUARD CERTIFIED •
- MPD, MPA, TPX, PCS AND ALL CURRENT PRODUCTS •

Route 2, Box 338C • Lynchburg VA 24501  
ERICSSON 804-237-3427

### PORTA-TECH

PORTABLE  
TECHNICAL  
SERVICE, INC.

121 Crowell Lane • Lynchburg, VA 24502



FACTORY TRAINED  
TECHNICIANS  
FOR QUALITY SERVICE

- GE Portable Radio Service Depot  
Factory Approved Nationwide
- Current Product Lines
  - Voice Guard Certified
  - Public Service Trunking
  - Surface Mount Technology

(804) 239-3049

### HERB SACHS, CONSULTING

Specialist in Public Safety Communications

P.O. Box 729  
Bowie, MD 20715  
301-464-4268

### ROBERT H. SCHWANINGER, JR.

ATTORNEY AT LAW

SCHWANINGER & ASSOCIATES  
1835 K STREET, N.W.  
SUITE 650  
WASHINGTON, D.C. 20006  
(202) 223-8837

### GE PORTABLE SERVICE

- FAST TURN
- WARRANTY
- \$48.00 hr./2 hr. MAX
- PARTS GE LIST
- RETURN UPS PAID



### Smith Communications Service

2121 W. Parrish Ave., Owensboro, KY 42301  
502-683-0936

### TROTT

COMMUNICATIONS GROUP

RAYMOND C. TROTT, P.E.  
Chairman

1425 Greenway Drive, Suite 350  
Irving, Texas 75038  
972/580-1911 • Fax: 972/580-0641

## prof. cons. services

### Engineering For The Wireless World

Wireless Communications Systems and Facilities

Define Acquire Build Manage  
Design Zone Test Operate

### RCC Consultants, Inc.

100 Woodbridge Center Drive, Suite 201  
Woodbridge, NJ 07095  
**800-247-4796**  
email - info@rcc.com  
Offices Nationwide & International

## accessories

**NEW!**

### WIRELESS CELLULAR CAR STEREO MUTE

ONLY 1 WIRE INSTALLATION + GROUND!  
"INSTALLS IN JUST 2 MINUTES"

Unique patented plug in fuse replaces car stereo fuse to cut out power to radio when unit detects the RF signal from any analog or digital cellular phone. When your phone rings, it shuts down the power to your car radio and turns radio back on when you end the call---all without any wires! (Will not work with PCS.)



Part No. 9122RFK

**\$49.95**

**ACCELE**  
ELECTRONICS, INC.

TEL: (562) 809-5090 • FAX: (562) 809-1248

Circle (75) on Fast Fact Card



# classified

## employment

### COMMUNICATIONS TECHNICIAN

Continuous Testing / Several Openings

County of Santa Clara (San Jose, CA) seeks individuals to service two-way radio, microwave and computer equipment used in public safety communications. Experience required. Salary: \$3,784-4,581 per month, includes County contribution to the Public Employees Retirement System for the 2% at 55 Plan; and includes payment by the County of the employee's regular contribution of approximately 7%. Excellent benefits.

For an application, please contact  
Communications Administration  
(408) 299-2711  
Equal Opportunity Employer

### PORTABLE/MOBILE TECHNICIAN

Motorola MSS in San Antonio, Texas, has immediate opening for a portable/mobile radio technician. Candidates should have extensive knowledge of Motorola portables and mobiles with emphasis on component-level repair. Candidate will also have extensive knowledge and experience working with service monitors, O'scopes, Power Meter, Freq. Counters and associated bench equipment. We offer competitive salary, Medical/Dental benefits and great working environment. Interested parties please fax resume to: (210) 226-5329, Attn: Greg.

Immediate opening for a **Portable Technician** in the Knoxville, TN area. Near the Great Smokey Mountains—a hunting and fishing paradise! Must have 5 years experience repairing Motorola and General Electric equipment. Excellent salary & benefits package. Contact Jim Hayes at (423) 546-0311.

### COMMUNICATIONS TECHNICIANS

Two positions available in our Salt Lake City office: mobile radio bench tech and portable radio bench tech. Both with current Motorola experience preferred. FCC or NABER certified with good oral and writing skills. Valid driver's license required.

45-year MSS offers full benefits, dental and 401k. Above average hourly wage commensurate with experience. Overtime occasionally required.

Highly qualified technicians with diverse experience are especially suggested to respond. Send resume and salary requirements to:

Utah Communications, Inc.  
Attn: Mike Miller  
1202 South 300 West  
Salt Lake City, UT 84101  
Phone: 801-486-0161 • Fax: 801-486-3822  
Email: [utahcomm@ix.netcom.com](mailto:utahcomm@ix.netcom.com)

### COMMUNICATIONS TECHNICIAN

Growing independent communications sales/service organization servicing the greater Kansas City area has an immediate need for one dedicated individual to join our team. Candidate must have five years service experience, including fixed & mobile field repair, mobile & portable bench repair and LTR experience. FCC and/or NABER certified preferred. Candidate must be customer oriented, well organized and willing to accept supervisory and training responsibilities. Top flight pay for excellent individual, benefits, bonus. Please send resume to Kevin.

Ph: 816-524-1047. Fax: 816-246-0677.

### TWO WAY RADIO TECHNICIANS

Growing Motorola MSS/SMR/Dealer is looking for two-way technicians with 2 or more years of experience (Motorola preferred.) Full benefits, good wages (\$12 to \$18 per hour) and excellent working conditions.

**BAYCOMM INC.**  
2040 Radisson St., Green Bay, WI 54302-2085  
Phone: 920-468-5426 • Fax: 920-468-8615  
[www.baycomm.com](http://www.baycomm.com)

### Communications Technicians

The City of San Jose, California, is seeking qualified applicants for the position of Communications Technician. Responsibilities include the maintenance and repair of land mobile type equipment, including mobiles, portables, pagers, voting receivers, base stations, mobile data systems, dispatch consoles and microwave systems. Position qualifications require any combination of training and experience equivalent to completion of a two-year college curriculum in radio communications or electronics and one year of experience in the maintenance and repair of land mobile equipment. Motorola experience preferred. Positions also require an FCC General Radio Telephone certificate or equivalent certificate from NABER/PCIA or APCO, and the ability to pass a medical exam and police background. Apply A.S.A.P. Salary range is \$4481.00-\$5446.00 monthly. Applications may be obtained by contacting:

City of San Jose  
Human Resources Dept.  
(408) 277-4205

### WIRELESS STAFFING SPECIALISTS

ALL LEVELS OF POSITIONS FILLED GLOBALLY  
• Technicians • Engineers • Managers • Sales  
Send resume to address below

Check web page for immediate openings  
[WWW.PERSONNEL1.COM](http://WWW.PERSONNEL1.COM)



**PERSONNEL RESOURCES, INC.**

P.O. Box 14570, Cincinnati, OH 45250  
E-Mail: [Carcercom@AOL.com](mailto:Carcercom@AOL.com)

☎ 606-491-5410 FAX 606-491-4340

Atlanta, Georgia is the fastest growing job market in the nation and Atlanta Communications is Atlanta's fastest growing MSS. We currently seek experienced Motorola System Technicians to support digital simulcast systems, single site trunking systems, multi-site data systems, & multi-site conventional systems. Top pay, good benefit package, excellent work atmosphere, company vehicle. Positions also available for mobile, portable, and field technicians. If you seek a challenging work environment and excellent amenities (cultural & recreational), Atlanta is the place to be! Please submit your resume to Ron Thomas at 404-875-1691 or email to [theradioman@mindspring.com](mailto:theradioman@mindspring.com).

Use Color  
TO MAKE YOUR AD  
Stand Out!

### ELECTRONIC COMMUNICATIONS TECHNICIAN

Los Angeles County Department of Public Works is seeking a journey level individual, with experience in state-of-the-art telecommunications. Able to assist in design, installation, maintenance, repair and documentation of the Department's integrated data, telephone, radio, and telemetry communications systems. Capable of troubleshooting from the system level to the component level. FCC, APCO, etc. certificate. Able to operate within current Windows word processing and database programs. Must have good communication skills and be able to work in a team environment without direct supervision. Open until filled. Contact Personnel Division for Job Bulletin and Application at 626.458.2141. Exam No. C-6541-C; Bulletin No. 690-012; Salary: \$4380 per month.

Los Angeles County Department of Public Works. Personnel & Public Affairs Division  
900 S. Fremont Avenue, 9th Floor, Alhambra, CA 91803-1331



### TOWER TECHS NEEDED 40-year-old company-Central NC

RCS Communications Group  
Chris McClellan: 800-441-9191

### WIRELESS COMMUNICATIONS TECHNICIAN

Field technician-Must be experienced in systems: base stations consoles, microwave and data. PCIA or FCC certification preferred. Resume to:

Metropolitan Communications, Inc.  
309 Commerce Drive, Exton, PA 19341  
E-Mail: mcs@chesco.com  
Fax (610) 524-9970

**TelecomLatina** 17-19 November 1999 •  
Miami Beach Convention  
Center • Miami Beach, Florida  
U.S.A.

Telecom Latina'99 delivers the information and technology that communications professionals in Latin America need.

For information call 1-800-288-8606

### BUY•SELL•TRADE

MOT HT1000 Portable, UHF, 2 channel ..... \$300  
MOT HT1000 Speaker Mic ..... \$50  
GE Mastr II Mobile, 100w, silver handle  
with 1 pc. PA & EC element ..... \$90  
GE Mastr II Mobile, 100w, brown handle  
low band (42-50) ..... \$100  
high band ..... \$125

**HUGE SELECTION OF USED PARTS FROM  
GE & MOT BASES & MOBILES!**

**WOLFE  
COMMUNICATIONS**

1113 Central Avenue  
Billings, MT 59102  
Phone: 406-252-9220  
Fax: 406-252-9617

<http://members.aol.com/cwwolfe.com>

### Buy & Sell

Motorola, Uniden, E.F. Johnson, Kenwood  
Two-Way Radios and Systems



**DELTA  
COMMUNICATIONS**

1-800-880-2250  
FAX: 972-278-5085  
Garland, TX

<http://www.delta-twoway.com>

### GP-300 GP88

**SPECIAL PRICES and in STOCK!**

UHF 430-470 MHz  
VHF 136-174 MHz

E-mail: [info@nsiradio.com](mailto:info@nsiradio.com)  
<http://www.nsiradio.com>



**NSI Communications**

Tel: (206) 870-0888  
Fax: (206) 878-4212

GP-300 GP88 trademarks of Motorola Inc.

### Simulcast SOLUTIONS

716.223.4927 TEL  
716.223.3255 FAX

[www.simulcastsolutions.com](http://www.simulcastsolutions.com)



### GPS Master Oscillators

Circle (103) on Fast Fact Card

### Now You Can Solve Voter System Problems Fast!

#### Remote Comparator Display



Remote  
Voter  
Display  
Screen

- \*Control Voters from a Remote PC
- \*Cuts Costly Maintenance Time
- \*Finds Intermittent Problems FAST
- \*Reduces Receiver Downtime
- \*Logs Receiver Errors
- \*Modular & Expandable

**Call or Write for our FREE System Planner**

#### Transmitter Coverage Problems?



TSAM-1  
Transmitter  
Steering Unit

- \*Use with Multiple Transmitters to  
Extend System Coverage
- \*Automatic Transmitter Selection
- \*Far Lower Cost than Simulcast
- \*Fills Gaps in Existing Coverage
- \*Better than Relay Based Controller
- \*Works with Standard Base Stations

### CTI Products Inc.

Land Mobile Radio Solutions  
1211 West Sharon Road Cincinnati, OH 45240 U.S.A.  
513.595.5900

[info@ctiproducs.com](mailto:info@ctiproducs.com)  
[www.ctiproducs.com/landmobile](http://www.ctiproducs.com/landmobile)

Circle (93) on Fast Fact Card

### LOTS OF NEW TWO WAY RADIOS!

*Dealers Only.*

**For Immediate Delivery  
... At the Very Best Prices!**

ICOM vertex uniden YAESU KENWOOD  
**Radios starting at \$89!**

Portable, Base & Mobile Antennas: Decibel, Larsen,  
Maxrad, Hustler, Antenex, Cushcraft, ASP and more.

Programming hardware kit: \$89.00 Free items in 20+  
Icom repeater maker kit: \$79.00 Radios Ordered!

Conventional and switching  
power supplies: Astron & Samlex

Connectors, audio accessories, batteries, solar  
modules, R.F. amplifiers, lightning pro-  
tectors, trunking panels, interconnectors ...

Coaxial cable: Belden & Helix

R.F. test equipment: IFR, Bird,  
Optoelectronics, Ramsey

10' tower sections. Prices start at \$33.00

**Dealers Wanted !!**

**EPCOM**

ASK FOR YOUR 1999 CATALOG  
[www.epcom.net](http://www.epcom.net)  
[epcom@whc.net](mailto:epcom@whc.net)

1630 PAISANO DR.  
(915) 533-5119 FAX 542-4701  
EL PASO, TX, 79901 U.S.A.



Circle (94) on Fast Fact Card



# classified

## equipment for sale

BUY • SELL • TRADE • CLEAN WORKING EQUIPMENT

<b>Base Repeaters, Paging TX</b>		
4-MR-2000 VHF Base/Repeater 100W	From	\$1995
50-MR VHF Base/Repeater 100W	From	\$995
5-MSF 5000C 74CXB 7106 450 MHz 100W Repeater	From	Call
20-MSF 5000 C74CXB 7106 UHF 110W	From	\$2000
8-MR MCR-100 UHF 25 Watt Repeater	From	\$695
10-MR UHF Repeater 75 & 200 Watt	From	\$1495
20-GE 900 MHz-PRC-8/5 45W Repeaters & Digital Paging Station	Call	
10-MICOR 800 MHz Repeaters 125W	From	\$1000
20-MR II Base/Repeaters 60-250 Watt All Bands	From	\$1495
4-MOT Subbase Repeaters VHF/UHF 25W	Call	
Delta Base Table Top 100W w/Scan	From	\$1495
<b>Mobiles 25-50 MHz</b>		
50-Ranger 100 Watt 32 Channel	From	\$295
100-MHz 30-39 MHz 100 Watt	Sale From	\$150
300-MHz 35-50 MHz 80 Watt	From	\$50
200-MHz II 30-50 MHz 60-100 Watt	From	\$50
<b>Mobiles 150-174 MHz</b>		
5-Syntrix 9000 32 Ch 110W	From	\$995
6-Spectra 9000 110W 120 Ch	From	\$995
20-Spectra 40W 120 Ch	From	\$395
4-Ranger 99 Ch 100W	From	\$395
20-MCX-100 40W 10 Ch	From	\$100
20-Micor 12 Ch 100W	From	\$100
20-Syntrix 32 Ch 100W	From	\$100
300-Master IIE 8 Ch 100W	From	\$100
20-MX-340 12 Ch H43SSU1140AN	From	\$50
50-HT-220 4 Ch 5W	From	\$60
10-MHz 45-80 Watt 4 Ch	From	\$50
50-Syntrix X 110 Watt 32 Ch & DVP	From	\$200
20-MR II 60-100 Watt 8 Ch	From	\$50
50-Delta 3 100 Watt 16 Ch	From	\$100
50-PAC-RT 1.5 Watt Mobile Repeater	From	\$100
<b>UHF Mobiles 450-470 MHz</b>		
30-Syntrix X 9000 T74KEJ 110 Watt	Sale	\$495
10-Spectra T84FWA7H48AK 110Watt X9000	From	\$795
20-Syntrix X T34VBJ 32 Ch 40W	From	\$100
50-MR II 45-100 Watt Repeater Builders	From	\$100
15-MR PAC-RT Mobile Repeaters & VRS	From	\$200
30-MHz T44JA 50 Watt	From	\$100
50-Syntrix T44SRA	From	\$60
<b>800 MHz Mobiles</b>		
20-GE TMX 8310/8825/MDS	Call	
10-GE PG8MTX - 900	From	\$100
9-GE 19B80150P13 - 800	From	\$100
20-MTX 8000 B3, B5, B7	From	\$100
20-Syntrix X 9000, 35 Watt	From	\$100
5-Spectra T45KGA55/CBAK 1&2 SmartNet w/ VRS & Siren	Call	
50-MR II 15-35 Watt B-1-B-7	Sale	\$100
20-Spectra 900	Sale From	\$295
<b>Misc. Items</b>		
100-Centurion II Control Eq, Consoles, BIM, CEB, Panels, Cabinets	Call	
10-Spectra TAD Receivers & Voters	Call	
5-Securinet Decoders/Encoders	Call	
10-Centurion I Consoles & Lots of Parts	Call	
500-MOT & GE Tone & DC Remotes All Types	Call	

**BARNETT ELECTRONICS INC.**  
330 HWY 236 W., Leno, AR 72086  
ORDERS & INFO: 800-423-3858 FAX: 501-676-2478

For Expanded List, updated weekly, look at our Website: [www.barnettelec.com](http://www.barnettelec.com)

Info: 501-676-5506  
VISA & MC Accepted, NO COD's

Circle (76) on Fast Fact Card

NEW & USED EQUIPMENT

**MOTOROLA Radius**

Lowest Prices!

**GP 300 VHF/UHF**  
**GP 88 VHF/UHF**  
**GP 68 VHF/UHF**

Most popular models in stock!  
Complete Radius Line!

**KENWOOD**

New and Used

(some restrictions may apply)

Special State & Local Gov. Discounts

**1-800-264-9516**

**FAX 303-415-1557**

**COMMUNICATIONS WEST, LTD.**

E-Mail: [commwest@aol.com](mailto:commwest@aol.com)

**DOMESTIC & EXPORT SALES**

**LOWEST PRICES!**

PARTS • TURNKEY SYSTEMS • ANTENNAS

# A Passion For Excellence.

## Call Today For Your FREE Catalog!

[www.antenex.com](http://www.antenex.com)



**ANTENEX** INC.

Antenex is an established leader in the design and manufacture of innovative antenna products. Our latest Antenex Catalog is the perfect reference and buying guide for dealers. It features new products, as well as color photos, graphs, patterns, detailed descriptions and specifications of our full line of antenna products.

**United States:**

Phone: (800) 323-3757

Fax: (800) 851-9009

**International:**

Phone: (630) 351-9007

Fax: (630) 351-9009

Antenex Inc., 2000-205 Bloomingdale Road • Glendale Heights, Illinois 60139

Circle (77) on Fast Fact Card

**BUY & SELL:**  
**LTR-800MHz & 900MHz** EF Johnson • Kenwood • Uniden  
**MOTOROLA**

UHF • VHF • 800MHz • 900MHz  
• Mobiles • Portables • Repeaters • Amplifiers • Paging Transmitters

**1-800-786-2199**

203 N. Chestnut Street • McKinney, TX 75069

Fax: 972-562-7957

Mike Malone

[www.usedtwoway.com](http://www.usedtwoway.com)

**STERLING ASSOCIATES, INC.**  
Nationwide Purchasing and Sales of Used Two-Way Radio Equipment

**We Buy Used 2-Way Radio Equipment**



# classified equipment for sale

(540) 891-0569 We accept VISA and MasterCard Fax: (540) 891-0538



Massaponax Business Park  
3605 Loren Whitney Drive  
Fredericksburg, VA 22408  
Mailing Address:  
P.O. Box 7846  
Fredericksburg, VA 22404

- ▶ Two-Way Radio Communications
- ▶ New and Reconditioned Radios
- ▶ Custom-Designed Radio Systems
- ▶ Repair and Programming
- ▶ Consulting

Hi-power/Lo-band PL Mitreks 29.7-38.9MHz  
Saber I, UHF, DES hi-power (rack & indiv. chgrs, etc.)  
Mid-band bases secure

Console interface units  
Secure modems  
Secure spectratrac receivers  
Digitac comparators  
Centracom II CEB cards, cont. panels & complete  
GCC80 complete (MDC-1200 & MDC-600)  
MSF 5000 VHF Secure repeaters  
400W 150.8-162 & 162-174 rpters. - paging & secure  
250W 450-470 repeaters. - clear & secure

URL Address: <http://www.mechemelectronics.com>

E-Mail: [mechem@fls.infi.net](mailto:mechem@fls.infi.net)

Circle (78) on Fast Fact Card

## MOTOROLA RADIOS

RADIUS - RADIUS - RADIUS

NOBODY BEATS OUR PRICES—NOBODY BEATS OUR INVENTORY!

SP50-P110-GP300-GP350-P1225-P200-SM50-SM120-M130-M1225-GM300

MANY USED/DEMO TRUNKED & CONVENTIONAL RADIOS IN STOCK

HT1000-MARATRACS-SPECTRA-STX-MTX8000-GP68-PP1000X-MAXTRAC-MTX800



SALES: 800-545-7748 • FAX: 703-830-8710

VISIT US AT

<http://www.radioexpressinc.com>

Circle (79) on Fast Fact Card

## ERICSSON



## WHOLESALE

PRS radio sales to dealers only

- Mobiles
- Portables
- Conventional
- Trunked
- Accessories

Authorized Distributor

**Sharp**  
COMMUNICATION

[www.sharpc.com](http://www.sharpc.com)

1-800-548-2484



SAMLEX  
Power Supplies  
WHELEN  
Automotive  
Safety & Warning  
Signals  
COMMSHOP  
Software



Circle (80) on Fast Fact Card



## Communication Test Equipment

Motorola R2008C	\$4,500
Motorola R2002B	\$4,000
Motorola R2410A/HS	\$4,500
TTC T-Berd 107A T1 Set	\$2,950
HP 37701A T1 Set	\$3,000
HP 37441A SONET SET	\$3,000
Sage 930	\$3,500

EML will buy your used test equipment.

We accept:



(888) 846-4614 • [www.eml1.com](http://www.eml1.com)

Circle (81) on Fast Fact Card

WE  
BUY  
AND  
SELL  
USED  
MOTOROLA,  
GE AND  
ERICSSON  
FM  
TWO-WAY  
RADIOS

SCHAEFER  
RADIO CO.  
130 West  
Fayette St.  
P.O. Box 395  
Denver, IA  
50622

PHONE

(319)

984-6115

FAX

(319)

984-6220

- 3 ea. CELLWAVE Duplexers, 900 MHz, TDF6542A
- 11 ea. PURC 5000 Bases, 900 MHz, C85JL1101A
- 8 ea. MIDOR PURC Bases, 900 MHz, C75J2B1101A
- 10 ea. MAXTRAC, 800 MHz, D35M04S81AN
- 5 ea. GTX, 800 MHz, M11UG06C81AN
- 10 ea. MTX820S, 800 MHz, H25JG-S1C55AN
- 3 ea. STX, 800 MHz, H355T05170GN
- 2 ea. STX, 800 MHz, H35JNC05170GN
- 2 ea. STANDARD, 800 MHz, HX381T
- 1 ea. MIDOR Comm. Rtr., 450 MHz, C64RCB3105AY
- 6 ea. MIDOR Bases, 450 MHz, C64RCB3105AT
- 71 ea. SYNTOR X 9000, 450 MHz, T34KEJ7J04AK
- 77 ea. SYNTOR, 450 MHz, T44SRA3203
- 31 ea. MITREK, 450 MHz, T44JUA8000
- 2 ea. MCK105, 450 MHz, MBW24PSA7D00BK
- 9 ea. RADIUS, 450 MHz, H34GNIU6121
- 41 ea. PAC RT, 450 MHz, H14TTY3110A
- 1 ea. VSR2000 Rpt., 155 MHz, C73KS8310EB
- 2 ea. MIDOR Base, 155 MHz, C73RTB1145
- 1 ea. SPECTRA, 155 MHz, D430K47JATBK
- 9 ea. SPECTRA, 155 MHz, D430K47JASBK
- 99 ea. SYNTOR X, 155 MHz, T73V6J7D04BK
- 3 ea. SYNTOR, 155 MHz, T83SRA3000AK
- 3 ea. MITREK, 155 MHz, T83JUA3000
- 40 ea. PAC RT, 155 MHz, H13TY3110A
- 3 ea. SYNTOR X, 30-50 MHz, T71VL7204AK
- 30 ea. MARATRAC, 48 MHz, T81XAT7AD3AK
- 99 ea. MITREK, 48 MHz, T81JUA4000
- 10 ea. MIDOR Bases, 37 MHz, C71FTB1495
- 39 ea. MARATRAC, 37 MHz, T81XAT7AT5BK
- 99 ea. MITREK, 35 MHz, T81JUA4000DK
- 100 ea. Motorola SYSTEMS 90 Sirens
- 34 ea. Centracom I Tone Remote Modules
- 1 ea. Lot MC 400 MUX

WANTED: RADIUS Mobiles, Portables, Repeaters & UHF Synthesizers

## FOR SALE H-P-8920-A RADIO SERVICE MONITORS QUANTITY (15) FOR SALE WITH OPTIONS

- (5) H-P-8920-A OPTIONS 2/3/4/5/10/13 ..... \$8500
- (4) H-P-8920-A OPTIONS 2/3/4/5 ..... \$8500
- (6) H-P-8920-A OPTIONS 1/2/3/4/5/10 ..... \$8900



**ASKING  
\$8,500**

- 500KHZ to 1GHZ Frequency Range
- Spectrum Analyzer w/Tracking Generator
- Duplex Generator/Digital/Analog Signaling
- LTR/EDACKS/MPT-1327 Trunking Test
- High Stability OXCO
- 8 Month Warranty & 10-day Right of Refusal
- Tested and Calibrated

USED TEST EQUIPMENT WANTED,  
FAX YOUR LIST TO +1 925-229-2035

## RF IMAGING & COMMUNICATIONS

+1 925-229-2034 • FAX: +1 925-229-2035

<http://www.best.com/~rfimage>

E-MAIL: [rfimage@best.com](mailto:rfimage@best.com)

Circle (82) on Fast Fact Card

## CALL US FIRST at AIR COMM WHY PAY MORE!

Used/Reconditioned Motorola, E/GE, EFJ, Kenwood,  
Uniden 2-way radios and accessories  
—ALL FREQUENCY BANDS—

PLUS

"PL" and paging reads/filters, TCXOS

Call us last to sell any of the above.

WE PAY CASH



4614 E. McDowell Rd. Ph.: 602-275-4505  
Phoenix, AZ 85008 Fax: 602-275-4555



# classified

## equipment for sale

### DEALERS WANTED

Now you can be a dealer in a new line of  
**MOTOROLA 2-WAY RADIOS**

### WETEC ELECTRONICS

**AUTHORIZED MOTOROLA TS-11 DISTRIBUTOR**

Call Now **1-888-GO-WETEC, ext. 11**  
Visit our website at: [www.wetec.com](http://www.wetec.com)

**World's First Talking 32 Channel Radio**

### SUPER BUYS

- Motorola 450 MHz LTR, NEW  
List \$580 ea., Dealer cost \$350 ea.  
Your Cost ..... \$300 ea.  
—Limited Time Offer—
- GTX 800 MHz Mobile ..... \$199
- MTX 8000's – B3's portable .... \$199 ea.

Circle (84) on Fast Fact Card

**COMPLETE CHANNEL ELEMENTS  
YOUR FREQUENCY  
LIFETIME GUARANTEE  
Most Elements \$20.00 With Trade**

Crystals  
We Buy Used Elements

### NKX

1814 Hancock St.  
Gretna, LA 70053  
504-361-5525 (in LA) • 800-237-6519  
FAX 504-361-5526

CMC ENTERPRISES 2-WAY, MICROWAVE & TELECOM EQPT.		
Quantity	Equipment List	Price
5000	Andrew 1-58' LDF-53 Helix (NEW)	\$5,000 ea.
15	Farnon PAS6000E HOT stubby 6GHz radios (per terminal)	\$3500 ea.
06	Rockwell-Collins MP6-2 HOT stubby 6GHz (per terminal)	\$3000 ea.
50	Motorola Starplex Channel Modems MLN6287	\$200 ea.
35	Motorola Maratrac 3C-36 110w w/acc	\$325 ea.
05	Motorola MSF 5000 UHF Rptrs 100w chip program	\$2800 ea.
05	Motorola MA-600 Non-stubby loop radios 6GHz 300ch	\$1000 ea.
40	Motorola Mirek 30-39 PL (SYS-90 Acc) 110w	\$175 ea.
50	Motorola Starplex Term Cards MLN6288	\$80 ea.
03	Motorola Comparators, signal to noise type	\$400 ea.
14	Kenwood 601-S 16ch 42-50 mobiles	\$150 ea.
06	Centracom II Consoles, less CEB	\$500 ea.
10	Motorola MA-600 hot-stubby 6GHz 300ch	\$1500 ea.
05	Farnon PAS-6000E non-stubby loop radios 6GHz 300ch	\$2000 ea.
08	Farnon LR1-2 Hot-stubby 2.1-2.3GHz 48ch	\$1500 ea.
08	Motorola Starpoint 2.1-2.3GHz radios w/Hot-stubby	\$1800 ea.
12	Motorola Maratrac A2 UHF 110w w/acc	\$375 ea.
12	Farnon RL 1-66GHz radios w/Hot-stubby, Very Good condn	\$2000 ea.
15	Motorola Synter X 9000 UHF 110w w/acc	\$400 ea.
01	Scientific-Atlanta 4653a BERTS Transmitter (DS1VC2)	\$1000
New Listing! Call Charles at 336-769-2885		
For more equipment, visit our website at <a href="http://www.cmcent.com">www.cmcent.com</a>		

**KENDOO™  
BATTERIES**

The perfect match  
For  
MOTOROLA • YAESU  
ICOM • KENWOOD  
MAXON • STANDARD  
NiCd or NiMH

Large Inventory  
Best Quality  
Unbelievable Price

1950 NW 94th Ave.  
Miami, FL 33172  
Tels.: (305) 592-9688  
(305) 592-9898  
Fax: (305) 592-4562  
E-Mail: [sales@kendoo.com](mailto:sales@kendoo.com)  
[www.kendoo.com](http://www.kendoo.com)

Circle (83) on Fast Fact Card

### Price Industries®



Fax 405-350-1455

Visit us at [www.priceindustries.com](http://www.priceindustries.com)

### Ericsson® Compatible Programming Equipment

- P96A Programmer®
- Can replace TQ3370®
- 4 LED indicators
- Tx, Rx Data, Power on, Flash
- Only \$ 120 plus \$4 shipping
- 30 Day money back guarantee
- 1 Year Parts and labor guarantee



Circle (105) on Fast Fact Card

### MEMORIES FADE...

After 1 month.

Make sure the memory of your ad stays with your target audience.

CALL 800-347-9375

### MB BASE TRANSCEIVER



RADIO COMPANY



- 118.000-135.975 MHz • 10 Watt Output • Performance Monitors • Options — 1-6 Channels, Remote Operation, Rack Mounting • Other Civil Aeronautical Radios • Mobile • Radio Light Control • Nav Signal Monitor/Alert •



One Channel Standard  
Up To 6 Channels Optional

### AIRPORT MOBILE COMMUNICATIONS



RADIO COMPANY

• 1561 LOST NATION ROAD • WILLOUGHBY, OHIO 44094 U.S.A. • Phone (440) 942-2025 • Fax (440) 942-9129 •



## Audio Accessories for 2-Way Radios!

**Klein**  
**electronics**  
**(800) 959-2899**

Fax: (760) 631-1163

E-mail: info@kleinelectronics.com

Web: www.kleinelectronics.com

**Call Now!**

K700-  
"Public Safety"



Tactical Headset  
Bike Patrols  
SWAT Teams

K500-  
"Top Seller"



Dual Muff Headset  
for Safety Helmets

K400-  
"Best in Class"



Dual Muff  
Headset w/Noise  
Cancelling Mic

K9725-  
"Easy to Use"



Heavy Duty Remote  
Speaker Mic

K111-  
"Affordable"



2 Pc.  
Lapel Kit

Circle (85) on Fast Fact Card

## PRE-OWNED RADIOS!

We currently have a selection of pre-owned radios, as well as chargers and accessories. Call for more information and great prices!

UHF	Qty.	MT2000 168 Channel	4
P110 2 Channel	16	Visar 16 Channel	14
P110 4 Channel	14	VHF	Qty.
P110 6 Channel	21	P110 6 Channel	14
SP50 2 Channel	1	SP50 2 Channel	22
SP50 6 Channel	5	SP50 10 Channel	3
P200 6 Channel	97	P200 6 Channel	24
GP300 16 Channel	140	GP300 2 Channel	4
GP350 16 Channel	87	GP350 16 Channel	9
P1225 16 Channel	15	P1225 16 Channel	2
HT1000 16 Channel	6	Visar 16 Channel	14
MT1000 100 Channel	2	All radios include a 30-day warranty.	

Open 7 Days 8am-8pm  
Call to place your order or  
to request a FREE catalog!

**1.800.272.7111**  
www.racingelectronics.com



## CHANNEL ELEMENTS YOUR FREQ. - \$20.00

with trade-in/3 working days

## CRYSTALS

MAXON, TEKK, UNIDEN/7working days

Channel Element HQ/Kirby Ent.  
4120 Kirby Rd. Cincinnati, OH 45223

**1-800-237-9654**

FAX: 513/542-8870



## REMOTELY MONITOR RF POWER FROM \$150

(as seen at the IWCE show)

Finally, a low cost, building block approach to remote sensing where you decide the level of monitoring. For as little as \$150, our digital RF POWER SENSOR will display both an analog meter and a digital readout of what's happening at your site, all from the convenience of your home office computer. Other monitoring units available

Tele: 847-891-2584

Fax: 847-891-2587

www.glentech-rf.com

Circle (86) on Fast Fact Card

## N.H. COMMUNICATIONS CO.

MOT Maxar 80, 45w, VHF mobile, PL & accessories	\$195
MOT Maxar 80 4 freq. UHF w/acc	\$195
MOT Maxar 80 mobile, 60w, 30-36mc PL	\$195 ea.
MOT Maxar 80 mobile, 60w, 42-50mc PL	\$195 ea.
MOT Flexar UHF base, PL, 2 freq, local & DC remote, desk mic	\$195 ea.
MOT Radio Test Set, Model R-1033 A	\$575 ea.
MOT Maratrac low band mobiles 100w 42-50mc w/acc, PL	\$395 ea.
MOT Syntor 110w VHF mobile, 4 freq scan w/ accessories	\$195 ea.
MOT MaxTrac 300 UHF 16 freq scan, 40 w base station w/ power supply and desk mko	\$335 ea.
MOT MaxTrac 300 UHF 16 freq scan, 40 w base station w/ power supply and desk mko	\$535 ea.
MOT Mitrak low band mobiles 100w 40-50mc w/acc, PL	\$195 ea.
MOT Mitrak 50w UHF mobiles w/acc, PL	\$180 ea.
MOT Mitrak 100w base, 30-40mc, local/remote control mod., PL	\$995
MOT Mitrak 100w base, 40-50mc, local/remote control mod., PL	\$995
MOT Mitrak 110w VHF base, PL, local/remote control mod., PL	\$995
MOT outdoor cabinets, never outdoors, 70" x 21.5" x 23.5"	\$600 ea.
MOT Mitrak low band mobiles, 30-40mc, 80w, w/acc, PL	\$165 ea.
MOT Micor mobiles VHF 110w, PL, w/acc	\$195 ea.
MOT Micor mobiles, 100w, UHF, PL, w/acc	\$195 ea.
MOT Micor 100w mobiles, 42-50mc, w/acc	\$195 ea.
MOT Micor 800mc base station	\$295
MOT Mstar UHF mobile, 8 freq scan, w/acc	\$195
MOT Pak Rat repeaters VHF	\$150 ea.
MOT Mocom 70 UHF base, PL, desk mko	\$195
MOT Motrac VHF repeaters, 110w, Model C73M4Y3101AT	\$495 ea.
RARE FIND GE Mastir II 100w UHF repeater, continuous duty, single user channel guard, direct FM exciter, Mini	\$2995 Firm.
GE Executive II 60w, low band base station, wall mount, 30-36 mc, channel guard, DC remote	\$595
GE Mastir II 110w VHF continuous duty repeater	\$2,495
GE Mastir II 100w base station, 30-36mc	\$1,795 ea.
GE Mastir II 100w base station, 36-42mc	\$1,795 ea.
GE Mastir II 100w base station, 42-59mc	\$1,795 ea.
GE Mastir II 110w base station, VHF	\$1,795 ea.
GE Mastir Pro VHF 100 watt base station	\$395 ea.
GE Mastir Pro VHF 100w base station	\$395
GE Delta 100w, 42-50mc w/acc	\$195 ea.
GE Rangr mobiles 35-50mc 60w, w/acc	\$295 ea.
GE Rangr UHF mobile 100w w/acc & S550 scan head	\$595
GE Rangr UHF mobile 110w VHF w/acc & S550 scan head	\$595
GE Rangr UHF mobile 110w VHF w/acc & S550 scan head	\$595
GE Rangr UHF mobile 110w VHF 16 freq, standard head w/acc	\$495
GE Executive II VHF base station	\$175
GE Executive II 100w VHF mobiles	\$195 ea.
GE Mastir II 100w UHF mobile	\$495
GE 800mc Radio Programmer	\$250
GE S550 Scan heads	\$200 ea.
NEW GE Phoenix SX UHF mobiles w/acc	\$295 ea.
GE Phoenix UHF w/acc	\$195
GE Phoenix VHF w/acc	\$195
GE Phoenix SX UHF 16 freq	\$235
GE MLS VHF mobiles w/acc	\$295 ea.
Kenwood TK830 75w, UHF, 32 freq scan mobile	\$495
Kenwood TK860HK 35w, UHF, 32 freq scan mobile	\$395
Kenwood TK805D UHF 16 freq scan mobile	\$295
NEW Kenwood VHF & UHF portables, w/chrgs, batts. & ants.	\$357 ea.
Midland UHF 8 frequency mobile	\$165
Kenwood Model TK820 UHF mobile, 32 freq scan	\$225
Fluke Frequency Counter, Model 1920A, 5Hz-520MHz, w/acc, antenna, instruction manual	\$195
Bird Model 43 watt meter	\$125
Bird Coaxial Resistor Model 8135	\$145

WANTED TO BUY: GE Ericsson or Motorola Equipment

Pre-Paid Orders Only

No Credit Cards, No C.O.D.s

**N.H. COMMUNICATIONS CO.**

P.O. Box 5342

Manchester, NH 03108-5342

**Tel: 603-668-3004**

Circle (87) on Fast Fact Card

**Because it works.**

Call 800-347-9375  
today to place your ad  
in MRT Classifieds!

• BOARDS •	• STRIPS •	• ACCESSORIES •	• ELEMENTS •	• REEDS •
<b>PCI — PEKAAR COMMUNICATION INC.</b>				
<i>5 Specials of the month</i> Steve's back, formerly of Gregory Electronics Corp.				
MOTOROLA Mitrak Tabletop base model L-51 JJA 60 watt, low band 36-50 range			Special \$50 ea	\$150
MOTOROLA Mocom 70 table-top base UHF or high-band 40-60 watt				\$200
MOTOROLA Radios mobiles model D44LR73A5, 40 watt, 450-470 range, w/accessories				\$300
GE RANGER mobiles 100 watt, UHF with standard accessories				\$200
GE DELTA S Mobile—110w, high band, 150-170 range w/accessories				\$200
GE MLS mobiles high band, with mic & bracket				\$165
GE MPA Portable 15ch high band with antenna & battery				\$200
MOTOROLA Maxirac 800 model D35MQA5G65BK, 800 MHz range				\$125
GE PHOENIX Mobile NSHH1W40TB—high band dual priority scan/gray case with accessories				\$200 ea.
GE PCS Portable 470-490 range w/battery & antenna				\$175
GE portable model MPK or MPX UHF or high band, AS-4S				\$10
GE CMX 8030 mobiles 800 MHz range w/accessories				\$65
Ericsson GE MDS mobiles comb. TL800, 800MHz range w/accessories				\$98
Catalog Available...If you can't find it, try us! Call (973) 772-0704 or fax (973) 340-1902				
• REEDS •	• ELEMENTS •	• ACCESSORIES •	• STRIPS •	• BOARDS •



# classified equipment for sale

3 - NEW  
Radio Cables  
19, 20 & 21

## Radio Programming Cables

Model #s	The Motorola® Radio It Programs	Price
1	HT50 and the Radius P100 Models.	\$59. <sup>95</sup>
2	HT600, MT800, MT1000, P200, P500, MTX800, MTX810, MTX820, MTX900. (connection on top of radio)	\$85. <sup>95</sup>
3	MARATAC. (MAXTRAC - 50, 100, 300, 820, 840, M860), M1225. (RADIUS - M100, M205, M208, M214, M216, M400, GM300), SM10, SM50.	\$59. <sup>95</sup>
4	STX, STX Gemini, STX 821 trunked portables.	\$79. <sup>95</sup>
5	SABER and System SABER.	\$99. <sup>95</sup>
6A	SPECTRA Low and Medium Power Units.	\$79. <sup>95</sup>
6B	SPECTRA 100 Watt and High Power Units.	\$79. <sup>95</sup>
7	SYNTOR 9000 and 9000E Radio Line.	\$149. <sup>95</sup>
8	Radius P 50 Plus.	\$95. <sup>95</sup>
9	R100 Repeater.	\$49. <sup>95</sup>
10	MCX1000.	\$65. <sup>95</sup>
11	Cloning Cable for the Motorola® HT600 / MT1000.	\$79. <sup>95</sup>
12A	GP300, GP350, and P110 Models.	\$149. <sup>95</sup>
13	MSF5000 Digital Unit with 3 Digit Display in Controller Tray.	\$75. <sup>95</sup>
14	HT1000, MT2000, MTX 838, MTX 8000, MTX 9000 (connection on side of radio) and JEDI Series.	\$135. <sup>95</sup>
15	Visar Unit.	\$119. <sup>95</sup>
16	Cloning Cable for the Motorola® JEDI Series.	\$129. <sup>95</sup>
17	ASTRO SABER and SABER SI.	\$99. <sup>95</sup>
18	SP50.	\$99. <sup>95</sup>
19	M1225.	\$59. <sup>95</sup>
20	P1225.	\$119. <sup>95</sup>
21	HT750, HT1250.	\$79. <sup>95</sup>



Your Order Shipped Same Day! Order by 1pm EST.

## Compatible Motorola® Radio Programmers

### PA-I Programming Adaptor...\$139.95

- Compatible with "RIB" unit.
- Rugged steel case.
- Power LED.

### PA-II Programming Adaptor...\$159.95

- Contains rechargeable Ni-CAD Batteries.
- Perfect for field use and Portable, Laptop & Notebook Computers.
- Status LEDs: Power On and Charge.
- Power Switch.
- Power / Charger Included.
- Runs for 8 continuous hours, from a full charge.

### PA-III Pocket Programmer...\$189.95

- Micro-Size Design for Convenient Portability and Field Use.
- Uses Surface Mount Technology.
- Rechargeable --- Works hours on one charge.

NOTE: Hardware Only.  
Software sold by Motorola®  
and other products are  
trademarks of Motorola, Inc.

Polaris Industries Inc.  
470 Armour Dr. NE • Atlanta GA 30324  
FAX 404.872.1038

Polaris Industries Inc.  
470 Armour Dr. NE • Atlanta GA 30324  
FAX 404.872.1038

**1-800-752-3571**

## Polaris Industries

Tech info: 404.872.0722

www.polarisradio.com

### Compare These Important Points, Before You Buy!

- Same Day Shipping, When Ordered before 1pm EST.
- We Accept: American Express, Discover, MasterCard and Visa.
- Professional Users Guide with Detailed Photos Included with All Radio Products.
- Compare Polaris' Features and Quality. Don't Accept Imitations!

Circle (88) on Fast Fact Card

**SAVE BIG BUCKS ON  
Used 2 Way Radio**  
MOTOROLA • GE • EF JOHNSON etc.  
PORTABLES / PAGERS / MOBILES / BASES / REPEATERS

Contact us when you are looking for economical used equipment. We are a reliable source for all major brands of used 2 way gear

**(708) 681-0300**  
Buy • Sell • Trade

Visit our web site: [WWW.MDMRADIO.COM](http://WWW.MDMRADIO.COM)  
or E-Mail us at [mdmradio@earthlink.net](mailto:mdmradio@earthlink.net)

**MDM Radio Ltd.**  
1629 N. 31st Ave. Melrose Park, IL 60160  
Tel. (708) 681-0300 Fax (708) 681-9800

**ICT**

**TWO WAY RADIOS**  
LOWEST PRICES OF THE UNIVERSE!!  
Tons in Stock - Same day shipping guaranteed!!  
SP50 - P110 - GP300 / 350 - P1225 - P200 + GP68  
GP88 - SM50 / 120 - M120 - M1225 - GM300

**7875 N.W. 29th St. - Miami, FL 33122**  
**305.640.2424 - Fax: 305.640.0756**

Visit us at [www.ictwireless.com](http://www.ictwireless.com)

Circle (89) on Fast Fact Card

**PRIMEDIA Intertec Books**  
[www.internettelephony.com](http://www.internettelephony.com)  
**PRIMEDIA Intertec**

**DOES YOUR ADVERTISING  
WALK AND TALK?**

IF  
NOT GIVE  
THE LABEL EXPERTS  
A CALL !!

**Anchor Graphics Marketing, Inc.**  
"The Label Experts"  
972-242-0439 FAX 972-242-0959  
1-800-875-7859

**Radio Communications  
Wholesalers  
RCW**

Your Full Service,  
VALUE-ADDED Distributor of  
Communications Products.

Check out our Web specials!  
[www.radiocomm.com](http://www.radiocomm.com)

- Wholesale prices to Dealers Only.
- Self-servicing users welcome.
- We carry a wide selection of both radios and accessories for your convenience.
- We have a Flat Rate Repair service.
- We sell and install MX-COM boards.

**800-726-9015 • 612-808-0069**  
fax: 612-808-0087  
email: [sales@radiocomm.com](mailto:sales@radiocomm.com)

Circle (90) on Fast Fact Card



classified

equipment for sale

**Outnumbered  
Outgunned  
Got coverage?**

Vehicular repeaters extend hand-held communications by connecting to existing high-power mobile radios and repeating conversations in both directions. Hand-helds 1-2 miles from a vehicle maintain reliable communications with the base up to 50 or 60 miles away.

The SVR-200 vehicular repeater is a cost effective solution that provides full coverage for hand-helds in critical public safety applications.



Voice 714.901.5462  
Fax 714.901.5472  
www.pyramidcomm.com



Circle (91) on Fast Fact Card

All CCII  
Labels

WHITE, ORANGE, GREEN AND RED  
BUTTONS AVAILABLE

**\$12.50 ea**

CCII PROGRAMING AVAILABLE

ORDERS SHIPPED IN 14 DAYS

**NORTHEASTERN**  
Communications, Inc.

Waterbury, CT (203) 575-9008

Want to hear

**"YOU'RE  
HIRED!"**

THEN CHECK THE CLASSIFIEDS SECTION  
FOR EMPLOYMENT OPPORTUNITIES.

Don't miss our  
updated web site!  
Our pricing will  
shock you!

**Radius®**

\*See our NEW Motorola Dealer Referral Program

\*Introducing the Motorola TS11 "Motorola Radios for Resellers"

Visit our web site NOW or you'll not know what you're missing!

From your RADIUS LEADER,  
**PROCOMM**

INFORMATION: 805-497-2397  
805-494-5078  
8:00 - 6:00 pm Pacific Time

Ordering: 800-497-2394  
24-Hour Fax Line: 805-494-3115  
805-497-3430

VISIT OUR WEB SITE: <http://www.procommusa.com>  
e-mail: [procommusa@aol.com](mailto:procommusa@aol.com)

Where quality is #1, but where we want to be dead last when you call for pricing!

Circle (92) on Fast Fact Card



# classified equipment for sale

## BUYING ERICSSON-GE EQUIPMENT

FLAT RATE REPAIR S-990	60
VHF MASTR III Stations	3200
VHF MASTR II Stations	CALL
MASTR Controllers	100
RCN 1000 Remotes	135
MASTR II control shelf cards	CALL
IDA Control shelf, now from	200
VHF MASTR II special receiver	60
Delta/Rangr station from	450
S990 12ch head w/warranty	125
S600 4ch control head	50
S600 Delta/Rangr Accessories	150
PHOENIX-SX 16Ch VHF w/acc	150
PHOENIX-SX UHF w/acc	165
MLSH040 VHF MLS w/acc	250
MLS 35-42 & 42-50 w/acc	250
MLS 150-174 w/acc	275
ML 440-470 w/acc	225
KPC300 Ericsson VHF Port.	235
KPC300 Ericsson UHF Port.	235
MPA VHF/UHF Portables	CALL
MPA/MPD Std. rate chargers	42
MPI 8-unit multi-charger	40
RANGR 35-50 less acc. 60W	225
RANGR 30-42 less acc. 100W	225
Delta-S 450-470 less acc. 100W	225
Delta-S 150-174 less acc. 100W	200
Delta-SX 150-174 less acc. 100W	250
Delta-S 42-50 less acc. 110W	135
Delta-S 42-50 less acc. 60W	100
MASTR II 150-174 110W less acc.	115
MPA/MPD Vehicular Chargers	135

## NEW LONDON TECHNOLOGY

752 Alum Springs Road • Forest, VA 24551  
Tel: 804-525-0068 • Fax: 804-525-0078  
www.newlondontech.com

## FOR SALE: USED RADIOS

800 MHz LTR Mobiles  
EFJ ♦ Kenwood ♦ Uniden

800 MHz Motorola Mobiles  
Maxtrac ♦ Spectra

UHF Conventional  
Kenwood ♦ Midland ♦ Motorola

Call for Current Selection!

## MOBILE RADIO ENGINEERING

Ph: 612-544-3319 Fax: 612-544-2078  
E-mail: MRE@VISI.COM

## PROGRAMMING CABLES FOR MOTOROLA PRODUCTS

HT1000, MT2000—\$70

GP300, P110—\$50 • VISAR—\$110

HT600—\$48 • MOBILEs—\$25 • SABER—\$55

HT50—\$50 • STX—\$35 • SPECTRA—\$35  
PROGRAMMING INTERFACE—\$95

## ROADRUNNER COMMUNICATIONS

PO Box 654 • South River, NJ 08882

Phone: 732-254-3232

Fax: 732-257-4622

Advertising Works!

— Place Your Ad Today —

1-800-347-9375

## TEST EQUIPMENT - BUY & SELL!!

HP8901B Modulation Analyzer—\$2600 HP8901A—\$1200; HP8903B Audio  
Analyzers—\$1400; Anritsu MS2601A 2.2GHz Spectrum Analyzer—\$3900

### SERVICE MONITORS

HP8920A/102/3/4/5/13	\$7900	HP8920B 001/102/4/13	\$9500
HP8921A/600 (CDMA)	\$12,500	HP83236A PCS adapter	\$4000
HP8921A	\$8900	HP83236A (CDMA adapter)	\$500
IFR 1100S	\$3900	IFR 500A (like new)	\$4500
Wiltron Sitemasters	CALL	Eagle Return Loss Bridges	CALL
Wavetek 3600D (IS-136 TDMA)	\$8500		
Wavetek 3600D (IS-136, 1.9GHz PCS, Codex)	\$13,500		
Motorola R2000BH	\$7900	Motorola R2500A	\$6500
Motorola R2000CHS	\$7900	Motorola R2000B	\$3900
Motorola R2400A	\$4500	Motorola R2001D	\$5500
Marconi 2955A	\$2800	Marconi 2957A	\$2900
Marconi 2957D	\$4800	Marconi 2957B	\$4600
Marconi 2955B	\$4300		

Synth. 1000 MHz Signal Generators:

Racal 9087-1300MHz Signal Generators, low phase noise, high stability,  
AM/FM/Pulse/Phase Modulation, NEW units with warranty!—\$2400;  
HP8657A—\$2600.

**Amtronix**

Ph: 716-763-9104, 716-661-9964 • Fax: 716-763-0371

http://www.amtronix.com



**MIRAGE:**

The original NMO mount low profile antenna.



**MIRAGE II:**

Permanent mount "NGP" version of Mirage.

## ANTENNAS THAT WORK

Larsen offers you much more than  
mere low profile antenna options:

- DESIGN INNOVATIONS
- EXPERT ENGINEERING
- TECHNICAL PRECISION
- MECHANICAL DURABILITY
- REAL WORLD TESTED PERFORMANCE

Call today for a copy of

**THE LARSEN ANTENNA SOURCEBOOK™'99**

featuring our complete line of low profile  
antennas. **1-800-ANTENNA** in the US and

**1-800-663-6734** in Canada

VISIT OUR WEB SITE: [www.larsenantennas.com](http://www.larsenantennas.com)

E-MAIL: [larsen@larsenantennas.com](mailto:larsen@larsenantennas.com)



**SHADOW:**

Transit style, radome enclosed antenna.



**GPS DUAL BAND:**

Combines GPS with UHF, SMR, Cellular, Data  
or PCS frequencies.



**Larsen Antenna Technologies**



Circle (104) on Fast Fact Card



## Best Customer Service and Prices

Motorola 2-Way Radio

- GP68 w/ Hi-cap battery & rapid desktop charger
- GP68 w/ Hi-cap battery & standard desktop charger
- GP300 w/ Hi-cap battery & standard desktop charger
- HT 1000 w/ Hi-cap battery & standard desktop charger
- SP50 w/ standard accessories
- Mobiles, Trunking
- Accessories: Remote speaker mic, spare batteries, carrying case, etc.

All products come with factory warranty and genuine  
Motorola Accessories.

Payment Items: COD or Terms-On Approved Credit

Delivery within 8 business days

Our Office hours are Mon.-Fri.  
8am-5pm Central Standard Time.

**AMI (applied micrologic, Inc.)**  
**Sales: 800-410-3669**

Circle (95) on Fast Fact Card



# classified

## equipment for sale

### HP8920A

All options & manuals  
Original owner – \$6900  
**718-783-6000**

Will pay **TOP DOLLAR**  
for Motorola 800MHz Trunked  
Mobiles & Portables.

**Metro Communications LLC**  
**(423) 546-0311** – Jim Hayes

### Two Way Radios & Accessories ?

VHF or UHF Duplexers ?  
R.F. Test Equipment ? Solar Energy ?  
RF Connectors & Coax Cable ?  
Trunking Controllers & Repeaters ?

**HIGH QUALITY,  
IMMEDIATE DELIVERY  
& LOW PRICES !!!**

ASK FOR YOUR 1999 CATALOG

**EPCOM**

1630 PAISANO DR.  
(915) 533-5119 FAX 542-4701  
EL PASO, TX., 79901 U.S.A.

## OUTDOOR PRODUCTS

### 20D-78DD

(78"H x 48"W x 48"D)



☆ NEMA RATED

☆ MADE OUT OF  
OUR OWN  
ALUMIFLEX

- ☆ Powdered textured finish available
- ☆ Adjustable rails (front to rear)
- 4 sets of rails—19" EIA racking standard
- ☆ Four doors
- ☆ Available in: **two heights...**  
50 inches and 78 inches

**D.D.B. UNLIMITED INC.**

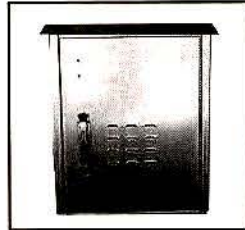
THE CABINET PEOPLE

**800-753-8459**

[www.ddbunlimited.com](http://www.ddbunlimited.com)

### OD-30DX

(30"H x 25"W x 25"D)



- ☆ Available in: **four heights...**  
30 inches, 50 inches, 62 inches & 78 inches  
and **three depths...**  
25 inches, 34 inches and 42 inches
- ☆ ALUMISHIELD—Top cover protects cabinet  
from the sun's heat and falling ice
- ☆ Rails—Fully adjustable and alodine coated
- ☆ Doors—Front and rear doors secured with  
stainless steel padlocking handles
- ☆ Vents—Front and rear, top and bottom with  
filtered panels (included)

Fans, A/C Units &  
Heaters Available

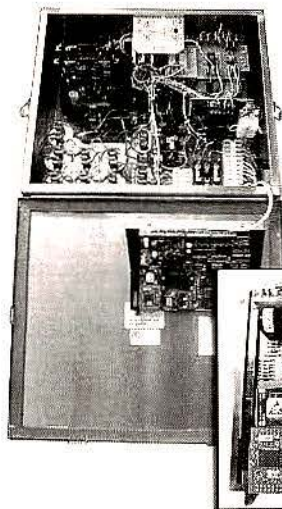
Circle (96) on Fast Fact Card

Want more information on  
advertised products?

Use the Reader  
Service Card!

Honeywell / Hughey & Phillips

## FLASH GUARD 3000™ ALARM MONITOR



- Flash Activity & Mode Verification
- Alerts Pager or NOC
- 4 Hour Battery Backup
- Temperature, Voltages and other  
Parameters monitored
- 8 External Alarm Contacts

FlashGuard 3000 is a Registered TM of Honeywell/Hughey & Phillips

**HARK**  
TOWER  
SYSTEMS

(843) 760-6115

(800) 367-4275

[www.harksystems.com](http://www.harksystems.com)

### FOR SALE

G.E. MLS, Phoenix, PSX, H. & UHF ..... from \$100  
G.E. Mastr II Base & Rep ..... CALL  
G.E. M11 Paging Base 462,925, 200w ..... \$3000  
MOT Radius & M.T. UHF 2 F Mint to Used ..... \$175 & up  
MOT Base Desk Trac 2F UHF Mint ..... \$495  
Lots of G.E. Station Cards M11 ..... CALL  
Call Dave @ **800-500-8055** • pob 462, Faribault, MN 55021

### CLEARANCE SALE

**3 Million** Genuine motorola  
radius parts in Stock !  
10% to 50% below NSO Price !

**EPCOM**

1630 PAISANO DR.  
(915) 533-5119 FAX 542-4701  
EL PASO, TX., 79901 U.S.A.

### BUY & SELL QUALITY USED EQUIPMENT

Motorola • Uniden • Kenwood  
Johnson • VHF • UHF • 800MHz  
900MHz • Mobile • Portables  
Repeaters

**PLANO COMMUNICATIONS INC.**  
**1-888-906-9006**

Circle (106) on Fast Fact Card



# RFCAD™

Wireless  
system  
planning  
Software

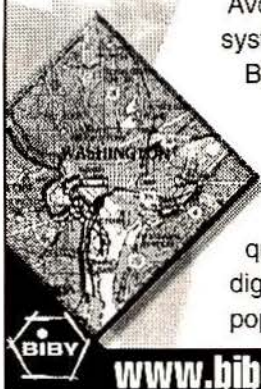
version 2.3

- Seamless USGS topographic maps
- Integrates with GIS
- Multiple terrain data
- Point to Point profile analysis
- Most Likely Server analysis
- Carrier to Interferer evaluation

Avoid surprises in your wireless system. **RFCAD's** field tested Biby-C algorithm and easily learned features make

"what if" scenarios simple, efficient and accurate.

**RFCAD** provides high quality signal strength displays on digitized USGS topo maps, or popular GIS software displays.



**www.biby.com 800-441-0034**

Circle (97) on Fast Fact Card

Maximize your company's  
exposure in the market-  
place by taking advantage of  
**REPRINTS!**



Call  
**Jenny Eisele**  
for a quote

**(913)967-1966**

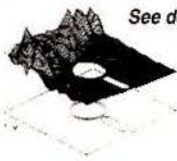
**Fax (913)967-1898**

## Find Solutions

To Your RF Coverage  
and Site Management  
Problems...  
On your own PC!

For either microwave links or area coverage, our Terrain Analysis Package (TAP)™ software helps you find system design solutions in-house.

See details and download demo from our web site!



**SOFTWRIGHT, LLC**  
1010 So. JOLIET ST, SUITE 204  
AURORA, CO 80012-3150 USA  
TEL. (303) 344-5486 • FAX (303) 344-2811  
www.softwright.com  
e-mail: sales@softwright.com

Circle (98) on Fast Fact Card

Next Month is  
approaching fast.

Call

**800-347-9375**

to get your  
classified ad in the  
next issue!

### \*\* WIRELESS SOFTWARE \*\*

Save time designing, optimizing  
and managing wireless Radio  
communication sites:

- Intermodulation Interference Analysis
- Transmitter Noise Analysis
- Receiver Desense Analysis
- Signal Level Analysis
- Communications Site Design
- Site Management Database
- Equipment Maintenance and Inventory
- Desktop Mapping and Data Products

**COMSITE™**

CALL 800-845-0408 or 850-906-0748  
http://www.polaris.net/~douglas

## MEASURE SIGNAL COVERAGE!

- Automate field measurements and drive-tests.
- Create signal contours from measured data.
- Compatible with HP, IFR, Z Technology and other instruments.
- Use your NMEA or TSIP GPS receiver.
- Automatically records signal

**NEW**

**STI-9400 Software**

**\$4,995.00 Includes**

**Street Map Data for USA**

**FREE DEMONSTRATION CD**

Toll Free: (877) 848-8500 Fax: (503) 848-8534

Email: sales@surveytech.com

**Survey Technologies, Inc.**

"Geographic Signal Coverage At Your Fingertips"

**www.surveytech.com**

Circle (99) on Fast Fact Card



# classified

## computer software



**The worst mistakes are the ones you can't see.**

*Global Trunking Management  
& Billing Solutions for...*

SmartNet ♦ SmartWorks ♦ SmartZone  
LTR ♦ MPT 1327

For more information,  
call (903) 561-6673 or  
[www.GenesisWorld.com](http://www.GenesisWorld.com)

**Genesis**  
*where great ideas begin...*

Circle (100) on Fast Fact Card

**micropath<sup>®</sup> corporation**  
software and terrain data for communications engineering applications

**Radio Propagation Software**

- Predicted Area Coverage Maps
- Microwave Link Analysis & Profiles
- USGS GeoReferenced Topo Maps on CD-ROM

**[www.micropath.com](http://www.micropath.com)**

303.526-5454 Sales  
303.233-4242 Support  
303.233-4026 Fax  
e-mail: [sales@micropath.com](mailto:sales@micropath.com)

**Service - Sales - SMR Billing  
Pager Billing - Accounting**

**NOW AVAILABLE  
CRI - PRO  
YEAR 2000 COMPLIANT**

DOS • NOVELL • LANTASTIC • UNIX

We can provide complete solutions  
including software, hardware, and  
training.

**205-987-1523/205-987-1709 FAX**

Circle (107) on Fast Fact Card

**Buying? Selling? Just Looking?**  
**The MRT Classifieds is a great place to start!**

## services

### RF • CELLutions

1100 E. 64<sup>th</sup>  
Denver, CO 80229  
Phone: 303-227-3210  
Fax: 303-227-3220

Complete site Engineering and  
Design, Consulting, site Optimization,  
Expansion, site Management, site  
Maintenance, site Acquisitions and  
Technical assistance.

We can provide all your RF Communi-  
cations needs, from Engineering to  
site construction.

Ask RF • CELLutions about the multi-  
carrier power cell, (MPC) Re-Radiator,  
best way to extend your  
communications sites.

Contact RF • CELLutions  
We can answer all your questions.

### STUDY LAND MOBILE COMMUNICATIONS AT HOME!

38 Lessons written exclusively for Mobile  
Communications Servicing. \$375.00

Call, e-mail or write Mobile Training Institute  
for free information:



2111 Lakeridge Drive  
Grapevine, TX 76051-4614

817-488-2796 or [mtimti@aol.com](mailto:mtimti@aol.com)

## business opportunity

### ★★★ FOR SALE ★★★

Electronics shop, 2-way radios, scanners, etc.  
Bldg. land, svc van, test equipment, large  
inventory - \$100,000. *Added bonus:* 2,000 sq.  
ft. home in excellent condition in small town.

**1-888-676-4502**

## tower services

### TOWER



- Fabrication
- Design
- Engineering
- Installation
- Service
- Maintenance

Swager is your  
worldwide turnkey  
tower company.

Phone  
**1-800-968-5601**  
or Fax  
**1-800-882-3414**



**SWAGER**  
Communications, Inc.

P.O. Box 656

3560 East Swager Drive  
Fremont, IN 46737 USA

Phone 1-800-968-5601 • 219-495-2515

Fax 1-800-882-3414 • 219-495-4205

E-mail: [sales@swager.com](mailto:sales@swager.com)

Internet: [www.swager.com](http://www.swager.com)

Circle (101) on Fast Fact Card

## tower space

### ARIZONA'S PREMIER TOWER FACILITIES

Contact Rick or Charlie Bonifasi  
**ANTENNA SITES, INC.**  
**800-346-7224**



CHECK THE FACTS THEN  
CALL THE BEST!

**CHICAGO TOWER LEASING CORP.**

Environmentally controlled  
equipment enclosures, back-up power,  
RF engineered sites. Secure.

Premiere sites in Metro Chicago Area—choice of  
Federal State, Govt. & all Class A Systems.

STAN STANN  
105 MURPHY LAKE ROAD  
PARK RIDGE, IL 60068

**(847) 823-7713**



# classified

## repair services

### Cushman / IFR / Motorola / Wavetek

Get Your Test Equipment Needs  
From Service Professionals.  
We Buy & Sell Service Monitors.

Communication Service Monitor  
Repair & Calibration Specialists

NS Electronics Service, Inc.  
3610 Dekalb Technology Pkwy.  
Suite 110/111  
Atlanta, GA 30340  
Phone: 770-451-3264  
Fax: 770-458-8785



www.nselectronics.com



**Triton  
Electronics, Inc.**

**SERVICE MONITOR  
REPAIR & CALIBRATION**

Exclusive monitor repair since 1973  
**NIST TRACEABLE**

Cushman, IFR, Motorola, Marconi  
Also, Voice Logging Recorders

4300 Lincoln Ave., Unit 0  
Rolling Meadows, IL 60008

(847) 934-6426 Fax: (847) 934-7195

★ Visit our Website: <http://www.tritonelec.com> ★



### Loudoun Communications Inc.

Communications Systems

**REPAIR DEPOT**

QUALITY SERVICE ON MICROPROCESSOR-BASED  
MOBILES, PORTABLES AND CONTROL HEADS.  
SURFACE MOUNT REPAIR. MOST REPAIRS \$70 PLUS PARTS.  
**FREE ESTIMATES.**

Warranty Service Available On:  
Ericsson/G.E. • Kenwood

585 Factory Shoals Rd.  
Austell, Ga. 30168

770-948-9566



**Fishing  
for new  
customers?**

**Try MRT  
Classifieds!**



Minitor II Pager  
Repair Just \$29.50  
Price includes all  
Parts and Labor

**5 Day turn time  
90 Day Warranty**

Water/Physical damage and  
housing parts not included



Paging and Wireless  
Service Center

**800-822-2180**  
Fax: 561-683-0059

1300 N FL Mango Rd #26  
West Palm Beach, FL 33409 Dealer price

### PLACING YOUR CLASSIFIED AD IS EASY

1. CALLDOWN RHODEN: 800-347-9375
2. FAX YOUR AD TO: 913-967-1735
3. MAIL YOUR AD MATERIALS TO:  
KRISTI WOODS  
9800 METCALF AVE.  
OVERLAND PARK, KS 66212-2215

**MOTOROLA &  
ERICSSON**

**\$49**  
Flat Rate  
Plus Parts

PORTABLE & MOBILE REPAIR

- Quick Turn Around • Free Return Shipping
- Factory Trained & FCC Licensed Techs



**800-567-5636**

11420 NW 45th Place • Sunrise, FL 33323

### IT IS POSSIBLE!!!

...to receive quick, quality, service at affordable rates.

We repair:

- Transmitter Amplifiers.
- Tower top Amplifiers. (most makes & models)
- Filters, duplexers & combiners re-tuning.
- Special custom projects & equipment modifications.

**ADVANCED COMMUNICATIONS  
& ELECTRONICS INC.**

2054J Airport Road (804) 237-8255  
Lynchburg, VA 24502-3757 Fax/Phone: (804) 237-4762  
E-Mail: [advcomm@worldnet.att.net](mailto:advcomm@worldnet.att.net)

## rentals

**MOTOROLA® 2-WAY  
RADIO RENTALS**

- Top Quality • Low Cost
- Overnight Delivery Anywhere

**MOSS  
COMMUNICATIONS**  
**800-822-MOSS**  
[www.mosscomm.com](http://www.mosscomm.com)

### MOTOROLA RADIO RENTALS

- HT1000, GP300, P200
- Intrinsically Safe
- Full Line of Radio Accessories
- Mobiles & Repeaters
- 24-Hour Service
- Dealer Inquiries Invited

**1-800-283-COMM**

EVENT RENTAL COMM., INC.  
e-mail: [eventcomm@aol.com](mailto:eventcomm@aol.com)

## paging

Pagers • Parts • Equipment • Cellular • Training

ISO 9001 Quality  
Life Time Warranty

**Check Out Our LOW PAGER & CRYSTAL PRICES**

All Popular Pagers & Cell Phones,  
New & Refurbished, Bought & Sold

Complete Line of LCDs, Trim Caps  
Vibe Motors & Parts

Certified Pager Repair  
Training & Online Support

Wide Range of Service, Repair  
& Test Equipment

Factory Original Programmers

Large Range of Password Erasers

**CRYSTALS** Over 3500 Different  
Freqs. in stock

**ALL PAGERS**

**\$1.95 \$2.95**

**PagerPro**  
The most unique and  
full featured product  
ever offered to  
the pager  
service industry!

**WIRELESS  
TECHNOLOGIES**

**www.pageco.com**  
**info@pageco.com**

**Tel: 954-491-9501 Fax: 954-491-8834**

Circle (102) on Fast Fact Card



# ad index

Company	Page Number	Fast Fact Number	Advertiser Hotline	Company	Page Number	Fast Fact Number	Advertiser Hotline
AEA, division of Tempo Research	52	51	760-598-8900	Larsen Electronics	63	104	800-426-1656
AMI-Applied Micrologic Inc.	63	95	817-568-8550	Mechem Electronics	58	78	540-891-0569
Anritsu Company	9	8	800-ANRITSU	Modular Communication Sys	17	16	818-764-1333
Antenex	57	77	800-323-3757	Motorola Test Equipment	13	12	800-422-4210
The Antenna Specialists Co. a division of Allen Telecom	20	17	440-349-8400	Narda/L3 Communications	7	7	516-231-1700
Astron Corp	21	18	949-458-7277	New Hampshire Communications	60	87	603-668-3004
Barnett Electronics Inc.	57	76	800-423-3858	Norcomm Corp	50	49	800-874-8663
BatteryPRO Systems, Inc.	47	47	800-661-9401	PageCo	67	102	954-496-9501
Berkeley Varitronics	39	40	732-548-3737	Paging & Wireless Service Center	41	42	561-683-0022
CES Wireless Tech	30	26	800-292-1700	Polaris Industries	61	88	404-872-0722
Chase Systems	12	11	973-252-6605	Polyphaser Corp	46	46	800-325-7170
Citel America, Inc.	30	27	305-621-0022	Price Industries	59	105	405-350-1600
Communications Specialists	BC	3	800-854-0547	Procomm	62	92	805-497-2397
Communications Data Services	65	97	800-441-0034	Pyramid Communications	62	91	714-901-5462
Computer Resources Inc.	66	107	205-987-1523	Radio Express, Inc.	58	79	703-631-1365
Connect Systems, Inc.	33	31	805-642-7184	RCC Consultants	54	75	732-404-2400
Control Signal Corp.	16	15	800-521-2203	RCW Distributing	61	90	612-808-0069
CPI Communications Inc.	38	39	800-869-9128	RF Imaging	58	82	925-229-2034
Crystronics, Inc.	67	102	954-496-9501	Ritron Inc.	IBC	2	800-USA-1USA
CTI Products, Inc.	56	93	513-595-5900	Sharp Communication	58	80	800-548-2484
Daniels Electronics	49	48	250-382-8268	Shinwa Communications of America	36	36	800-627-4722
Dapa Communications, Inc.	5	6	716-373-7228	Shure Brothers, Inc.	15	13	800-25-SHURE
Dataradio	51	50	770-392-0002	Simulcast Solutions	56	103	716-223-4927
Davicom Technologies	37	38	877-327-4832	SoftWright	65	98	303-344-5486
DDB Unlimited	64	96	800-753-8459	Southwest Windpower	34	33	520-779-9463
Diversified Electronics	16	14	800-646-7278	Survey Technologies Inc.	65	99	503-848-8500
Doppler Systems, Inc.	34	32	602-488-9755	Swager Communications	66	101	800-968-5601
Duracomm Corp.	36	35	800-467-6741	Telepath	44	44	510-656-5600
Duracomm Corp.	44	45	800-467-6741	Telewave, Inc.	29	25	800-331-3396
EAGLE	32	30	520-204-2597	Thunder Eagle	37	37	888-877-8022
EF Johnson	1	4	800-388-1912	Times Microwave Systems	35	34	203-949-8400
EPCOM	56	94	915-533-5119	TPL Communications, Inc.	26	22	323-256-3000
EML	58	81	615-771-2560	Transcrypt International Ltd.	31	28	800-276-8878
EMR Corp.	43	43	602-581-2875	Trident Micro Systems	28	24	800-798-7881
The Genesis Group	66	100	903-561-6673	TX RX Systems Inc.	3	5	716-549-4700
Glentech	60	86	847-891-2584	Vega, A Mark IV Company	10	9	626-442-0782
Hark Systems, Inc.	64	106	843-760-6077	VERTEX/YAESU USA	IFC	1	562-404-2700
Hutton Communications	25	21	888-348-8866	Vocom Products Co. LLC	32	29	847-593-1213
International Cellular Telephone	61	89	305-640-2424	WETEC	59	84	901-286-6275
I-Tech	27	23	619-458-1500	W & W Manufacturing	23	20	800-221-0732
Kendoo Batteries	59	83	305-592-9688	Young Design	41	41	888-297-9090
Kenwood Communications	11	10	800-950-5005	Zetron Inc.	22	19	425-820-6363
Klein Electronics	60	85	760-631-2811	Zetron Inc.	53	52	425-820-6363



# YOUR ONE STOP SHOP FOR UHF TRUNKING

Available  
Now!  
Call for  
details.

**PATRIOT**  
PROGRAMMABLE REPEATER

PWR CD STATUS  
TEST MIC



## The Patriot Plus Series offers LTR and PassPort protocols

Ritron's earned reputation for efficient, versatile, and affordable in-plant radio systems has evolved to give you an edge against obsolescence by featuring backward compatibility, interoperability, and the advantages of trunking. You can now offer your customers affordable in-plant trunking systems and wide area UHF trunking with the new The Patriot Plus Portable radios.



Patriot Plus radios are manufactured in the U.S.A., feature new firmware and high performance electronics, and provide enhanced user features and benefits. LTR and PassPort protocol capable; Electronic Serial Number, and unique radio ID code for automatic roaming between affiliated systems. Narrow and wide band models are available. Updates, enhancements, as well as custom applications, are easily accomplished by use of field reprogrammable FLASH microcontrollers.

**Patriot SST Plus Portables** are ultra small with flexible features and economically priced. PC Programmable-3/2/1 Watts, 4 channels/modes, Loud and clear audio output, Built-in Quiet Call and DQC signalling.

**Patriot RTX Plus Portables** are ruggedly designed for long operational life. PC Programmable-4/2 Watts, 11 channels/modes, Designed to meet MIL-STD 810 C&D (shock and vibration) specifications, Companded audio, Loud and clear audio output, Built-in Quiet Call, DQC and optional DTMF Encode Signalling.

**Patriot RRX Programmable Repeaters** are designed with high performance specifications and loaded with features at an affordable price. RRX Repeaters deliver exceptional intermodulation rejection, sensitivity, and selectivity specifications for trouble-free service. The RRX is also ideal as a trunking exciter.

If maintaining and increasing your market share is important to you... then don't stop. Call us today at 1-800-USA-1-USA and GO with

Patriot Plus by Ritron for all your trunking needs.



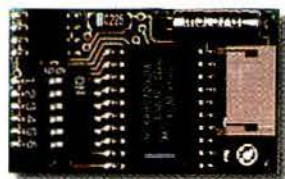
**PATRIOT PLUS**  
BY RITRON

505 West Carmel Drive, Carmel, IN 46032, Phone 317-846-1201, FAX 317-846-4978 [www.ritron.com](http://www.ritron.com)

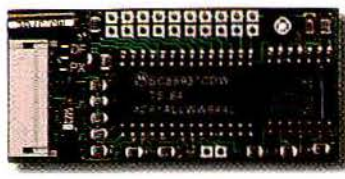
Circle (2) on Fast Fact Card

Ritron, Patriot, and Quiet Call are registered trademarks of Ritron, Inc. All other product names mentioned are used for identification purposes only and are trademarks of their respective owners.

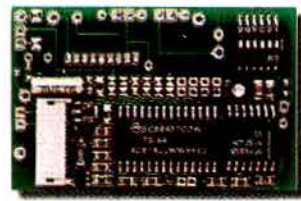




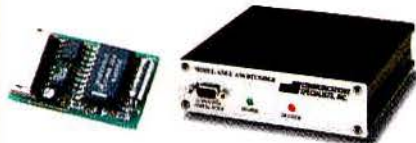
**SS-64** \$28.95  
Microminiature DIP Switch Programmable CTCSS Encoder.  
Includes 64 tones from 33.0 to 254.1 Hz.  
.66" x 1.08" x .21"



**TS-64** \$54.95  
Sub-miniature Programmable CTCSS Encoder-Decoder.  
Includes 64 tones from 33.0 to 254.1 Hz.  
.78" x 1.70" x .25"



**TS-64DS** \$57.95  
DIP Switch Programmable CTCSS Encoder-Decoder.  
Includes 64 tones from 33.0 to 254.1 Hz.  
1.25" x 2.0" x .30"



**ANI-1/\$39.95** **ANI-2/\$299.95**  
Automatic Number Identification System  
ANI-1 Encoder - 1.13" x .66" x .22"  
ANI-2 Station Decoder - 5.4" x 5.8" x 1.4"



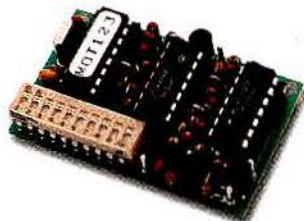
**ID-8** \$69.95  
Automatic Morse Station Identifier. Meets all FCC  
ID Requirements. Fully field programmable  
with included keypad. 1.85" x 1.12" x .35"



**TP-3200** \$279.95  
Full Featured Shared Repeater Tone Panel with ALL 157  
CTCSS/DCS codes. In Desktop or Rack Mount versions.



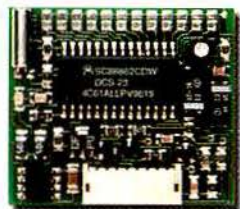
**PE-1000** \$224.95  
Desktop Paging Encoder. Two-Tone Sequential,  
other formats available. 7.5" x 7.8" x 2.7"



**SD-1000** \$59.95  
Two-Tone Sequential Decoder. Programmable unit  
provides switched outputs from Two-Tone paging calls.  
1.25" x 2.0" x .4"



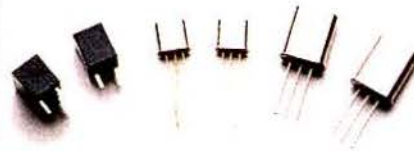
**PE-2P** \$54.95  
Two-Tone Sequential Encoder. Sub-assembly mounts  
inside radio or other enclosure. Multiple call capability.  
1.25" x 2.0" x .4"



**DCS-23** \$59.95  
Digital Coded Squelch Encoder-Decoder. Programmable  
to all 106 DCS codes. 1.36" x 1.18" x .25"



**TE-64D** \$129.90  
Multi-Purpose CTCSS/Burst Tone Encoder w/LED Display.  
Great for the Benchtop. 5.25" x 3.3" x 1.7"



**FILTERS**  
Call us for the lowest cost, 12.5kHz channel spacing,  
exact replacement, crystal and ceramic IF filters for  
Part 90 Refarming.

- Same reliable and cost effective products you have known and trusted for 30 years!
- Full FIVE YEAR WARRANTY on all products
- "INFO FAX" with 24 hour information
- Same day shipping on most orders
- Toll free 800 numbers for both voice and FAX



**COMMUNICATIONS SPECIALISTS, INC.**

426 WEST TAFT AVENUE • ORANGE, CA 92865-4296

(714) 998-3021 • FAX (714) 974-3420

ENTIRE U.S.A. (800) 854-0547 • FAX (800) 850-0547



Outside USA or Canada: Jascorn International, 30, 17th Avenue, San Mateo, CA 94402 USA • Phone (650) 574-1421 • FAX (650) 574-5297

See our complete  
catalog and product  
descriptions on our  
web site at

[www.com-spec.com](http://www.com-spec.com)

Circle (3) on Fast Fact Card